













#### SMITHSONIAN

# MISCELLANEOUS COLLECTIONS.

### VOL. XXIV.



"EVERY MAN IS A VALUABLE MEMBER OF SOCIETY WHO BY HIS OBSERVATIONS, RESEARCHES,
AND EXPERIMENTS PROCURES KNOWLEDGE FOR MEN."—SMITHSON.



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1883.



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S. F. BAIRD, Secretary S. I.



#### Department of the Interior:

U. S. NATIONAL MUSEUM.

### BULLETINS

OF THE

#### UNITED STATES NATIONAL MUSEUM.

VOLUME III. (No. 16.)

PUBLISHED UNDER THE DIRECTION OF THE SMITHSONIAN INSTITUTION.

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#### TABLE OF CONTENTS.

Synopsis of the Fishes of North America. By David S. Jordan and Charles H. Gilbert. 1882. 8vo., pp. 1074. Bulletin of the National Museum, No. 16.

VII



#### Department of the Interior:

U. S. NATIONAL MUSEUM.

16

## BULLETIN

OF THE

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1882.

#### ADVERTISEMENT.

This work is the sixteenth of a series of papers intended to illustrate the collections of natural history and ethnology belonging to the United States, and constituting the National Museum, of which the Smithsonian Institution was placed in charge by the act of Congress of August 10, 1846.

It has been prepared at the request of the Institution, and printed by authority of the honorable Secretary of the Interior.

SPENCER F. BAIRD,

Secretary of the Smithsonian Institution.

Smithsonian Institution,

Washington, May 20, 1882.

ii

### SYNOPSIS

OF THE

## FISHES OF NORTH AMERICA.

BY

DAVID S. JORDAN

AND
CHARLES H. GILBERT.

WASHINGTON:
GOVERNMENT PRINTING OFFICE,
1882.



#### PREFACE.

In this memoir we have endeavored to give concise descriptions of all the species of fishes known to inhabit the waters of North America, north of the boundary between the United States and Mexico.

The classification which we have adopted is essentially based on the views of Professors Gill and Cope, who have, it seems to us, been more fortunate in reflecting nature in their groupings of the fishes than have any of the European systematists. In our arrangement of the families and genera, we have endeavored to avoid, on the one hand, unnatural associations, and on the other, subdivision beyond reasonable limits. Genera to which we have been unable to give precise definition have been rarely adopted.

The rules of nomenclature generally recognized by naturalists, and recently admirably formulated by Mr. W. H. Dall, have been followed without deviation, except such as may be due to ignorance of all the facts in any particular case. Most of the present confusion in nomenclature is due to the neglect of established rules, and the only way out of this confusion is through the rigid enforcement of these rules. There is little hope for uniformity in nomenclature so long as individual preference or caprice is allowed to affect it.

We are under obligations to Prof. Spencer F. Baird, to Prof. G. Brown Goode, and to Dr. Tarleton H. Bean, for many aids, especially in connection with our use of the specimens in the United States National Museum. To Dr. Bean, in particular, we have been indebted for help of various sorts, including many unpublished notes. To Dr. Theodore Gill and to Prof. E. D. Cope, we are indebted for numerous aids and suggestions. Mr. Samuel Garman, of the Museum of Comparative Zoology, has given us considerable assistance on the Elasmobranchs. Mr. Chas. L. McKay, of the United States Signal Service, has revised

VI PREFACE.

onr account of the *Centrarchide*. Prof. S. A. Forbes, of the Illinois Laboratory of Natural History, has furnished numerous notes on the *Percide* and *Cyprinide* of Illinois. Prof. Felipe Poey, of Havana, has given valuable information in regard to the fishes of the Florida Keys. Professor O. P. Hay, of Butler University, has furnished us manuscript descriptions of species new to science. Miss Rosa Smith, Mr. Joseph Swain, and especially Mrs. Susan B. Jordan, have given important personal assistance in the verification of the descriptions in our manuscripts.

Finally, we may refer to the early encouragement received from Dr. Elliott Cones, whose advice and example led us to undertake to do for American Ichthyology, so far as lay in our power, what Cones' "Key to North American Birds" has done for American Ornithology.

A Bibliography of North American Ichthyology is soon to be published by Professor Goode. We have therefore not attempted to give a list of the works consulted by us. We have endeavored to examine everything pertaining to American Ichthyology.

Under the head of each species, enough synonymy has been given to connect this work with other descriptive works, and no more. Reference is made to the original description of each species, to the descriptions in Dr. Günther's "Catalogue of the Fishes of the British Museum," and to other works in which special information is given or in which some name different from the one adopted by us is employed.

This work was first prepared for the press in 1879, during which year a portion of it was printed. Since then the printing has been several times interrupted, chiefly by the absence of the authors while engaged in field-work. It was finished in September, 1882. The manuscripts unprinted have been from time to time revised, and each part has been brought up to the date of finally leaving our hands. The fact that the printing has extended over more than three years,—three of the most active years in the history of American Ichthyology,—will account for some discrepancies between the first and last parts of the work. In the Addenda, we have included the species which have been described since the printing of the accounts of the families to which they respectively belong.

DAVID S. JORDAN. CHARLES H. GILBERT.

Indiana University.

Bloomington, Ind., September 14, 1882.

PREFACE. VII

Note.—In our descriptions the *length* of the fish is always measured from the tip of the snout to the end of the last vertebra: the caudal fin being *not* included. The expressions "head 4" or "depth 4" mean that the length of the head, in the one case, or the greatest depth of the body, in the other, is one-fourth of the length of the fish. "Lat.1." indicates the number of scales in the lateral line; when, however, the number of transverse series of scales between the head and the caudal fin is different from the number pierced by the lateral line we have usually given the former number. The measurements given in the text are intended to apply to mature fishes. Young fishes have usually the depth less, the head larger, the month smaller, and the eye larger, than adult examples of the same species.

In the synonymy of any species, where an author quoted has used the name adopted by us, that name is not repeated. Descriptions not taken from specimens, or at least not verified by us, are, in all cases, credited to the author from whom they have been copied.

#### TABLE OF CONTENTS.

•	Page.
Class I. Leptocardii	2
Order A. Cirrostomi	2
Family 1. Branchiostomatidæ	23
1. Branchiostoma Costa	3
1. lanceolatum Pallas. (Addenda)3,	57,867
Class II. Marsipobranchii	3
Order B. Hyperotreta	4
Family 2. Myxinidæ	4
2. Myxine L	4
2. glutinosa L	5
Family 2 (b). Bdellostomatidæ. (Addenda)	967
3. Polistotrema Gill. (Addenda)	5,867
3. stouti Lock	, 57, 867
Order C. Hyperoartia	6
Family 3. Petromyzoutida	6,867
3 (b). Entosphenus Gill. (Addenda)	, 57, 868
4 (5, 6). tridentatus Gairdn	57,868
4 (5). Ammocœtes Dum	9,867
§ Lampetra Gray	7,867
7. plumbeus Ayres	8,867
7 (b). aureus Bean. (Addeuda)	868
§ Ammocates	9
8. niger Raf	9,867
8 (b). appendix Dek. (Addenda)	. 868
6 (7). Petromyzon L	10,867
§ Ichthyomyzon Grd	9,867
9. argenteus Kirt	10,867
9 (b). hirudo Grd	868
10. castaneus Grd	10,868
§ Petromyzon	867
11. marinus L	11,868
12. dorsatus Wild. (Addenda)	11,868
Class III. Elasmobranchii	12
Subclass Selachii	12
Order D. Squali	12
Family 4. Seymnidæ	13
8. Echinorhinus Blainv	14
13. spinosus Gmel	14
9. Somniosus Le S	14
14. microcephalus Bloch	15
Family 5. Spinacid®	15
10. Centroscyllium M. & H	16
15. fabricii Reinh	16
11. Squalus L	16
16. acanthias L	16
12. Centroscymnus Boc. & Cap	17
17. cœlolepis Boc. & Cap	17
11. Outotehn poor of out interesting	

Class III. Elasmobranchii—continued.	Page
Subclass Selachii.	
· Order D. Squali.	
Family 6. Scylliidæ. (Addenda)	17,55
13. Ginglymostoma M. & H	18
18. cirratum Gm	18
13 (b). Scylliorhinus Blainv. (Addeuda)	58,869
§ Catulus Smith. (Addenda)	869
18 (b). ventriosus Garm. (Addenda)	59,869
$1\overline{s}$ (c). retifer Garm. (Addenda)	869
Family 7. Carehariidæ. (Addenda)	18,870
14. Mustelus Cuv	19
§ Mustelus	59
19. canis Mitch. (Addenda)	19,870
§ Pleuracromylon Gill. (Addenda)	870
20. californicus Gill	, 59, 870
15. Triacis M. & H	20
§ Triacis	50
21. semifasciatus Grd	20
§ Rhinotriacis Gill. (Addenda)	59,870
22. henlei Gill	20,870
16. Galeorhinus Blainv	21
23. zyopterus J. & G. (Addenda)	870
17. Galeocerdo M. & H	21
24. tigrinus M. & H	21
18. Carcharias Raf. (Addenda)	872,967
§ Carcharinus Blainv	2
25. glaucus L	22
§ Platypodon Gill. (Addenda)	967
26. obseurus Le S	22
§ Eulamia Gill	22,60
26 (b), platyodon Poey. (Addenda)	872
27. cœruleus Dek. (Addenda)	872
27 (b). lamiella J. & G. (Addenda)	60, 873
19. Isogomphodon Gill	25
28. limbatus M. & H	2:
19 (b). Hypoprion M. & H. (Addenda)	61
28 (b). brevirostris Poey. (Addenda)	61
21. Scoliodon M. & H	2.
30. terræ-novæ Rich	2.
Family 8. Sphyrnidae	2:
22 (23). Sphyrna Raf	26, 87-
§ Reniceps Gill	2
31. tiburo L	25, 874
§ Sphyrna	26
32. zygena L	26
Family 9. Alopiida:	26
24. Alopias Raf	2
33. vulpes Gmel	2
Family 10. Odontaspididæ. (Addenda).	27,6
25. Odontaspis Ag. (Addenda)	27, 87
§ Eugomphodus Gill	2', 0'
34. littoralis Mitch. (Addenda)	27, 87
Family 11. Lamnida.	
26. Isurus Raf	
WU: AUMETIC ACCE	~

Class III. Elasmobranchii—continued.	Page.
Subclass Selachii.	
Order D. Squati,	
Family 11. Lamnide.	
§ Isuropsis Gill	ਹੁੰਤ
35 (36). dekayi Gill	2층, 574
27. Lamma Cuv	50
37. cornnbica Gmel	30
28. Carcharodon Smith	::0
38. carcharias L. (Addenda)	30, 575
Family 12. Cetorhinida	30
29. Cetorhinus Blainv	31
39. maximus Gunner	31
Family 14. Cestraciontidæ. (Addenda)	32, 62
31. Heterodontus Blainy. (Addenda)	32, 875
§ Gyropleurodus Gill	35
41. francisci Grd	33, 875
Family 15. Notidanidæ. (Addenda)	34, 62
31 (b). Hexauchus Raf. (Addenda)	62
41 (b), corinus J. & G. (Addenda)	65
32. Heptranchias Raf. (Addenda)	34, 62
§ Notorhynchus Ayres	34
42. maculatus Ayres (Addenda)	62
Family 16, Squatinida	35
33. Squatina Dum	35
43. angelns Dum	35
Order E. Raiæ	36
Family 17. Pristide	36
34. Pristis Lath	37
44. pectinatus Lath. (Addenda)	37, 575
Family 18. Rhinobatidæ	37
35. Rhinobatus B. & S	37
§ Rhinobatus. (Addenda)	<b>~7</b> 6
45. productus Ayres	38,876
45 (d). lentiginosus Garm. (Addenda)	65
§ Zapteryx J. & G. (Addenda)	876
45 (b). exasperatus J. & G. (Addenda)	63
§ Platyrhinoidis Garm. (Addenda)	576
45 (e). triscriatus J. & G. (Addenda)	64
Family 19. Torpedinidae	38
·	:34
36. Torpedo Dum	39
46. occidentaks Stor	
47. californica Ayres	39,876
36 (b). Narcine M. & H. (Addenda)	>77
47 (b), brasiliensis Olfers, (Addenda)	~77
Family 20. Raiidae	39
37. Raia L	:30
48. erinacea Mitch	1()
49. ocellata Mitch	.1()
50. radiata Donov	11
51. eglanteria Lac	41
52. lavis Mitch	43
53, granulata Gill	13
53 (b). ornata Garm. (Addenda)	r77
53 (c). plutonia Garm. (Addenda)	F7H
51 live where (tall (Addresse)	100 000

Class III. Elasmobranchii—continued.	Page.
Subelass Selachii.	
Order E. Raiæ.	
Family 20. Raiidæ.	
55. rhina J. & G	43
,	43,878
57. stellulata J. & G	44
57 (b), parmifera Bean. (Addenda)	878
Family 21. Trygonidæ	45
38. Urolophus M. & H	46
58. halleri Coop	46
39. Pteroplatea M. & H	46
5£, maclura Le S	46
60. marmorata Coop	47
40. Trygon Adanson. (Addenda)	
61. eentrura Mitch	
6I (b). hastata Dek. (Addenda)	70,879
62. sayi Le S	69,879
63. dipterura J. & G	
64. tuberculata Lac	
65. sabina Le S	, 66, 579 49
Family 22. Myliobatide	
41. Stoasodon Cantor. (Addenda)	50,879
66. narinari Euphr	50,879
42. Myliobatis Dum	50 51
67. freminvillei Le S	51
68. ealifornicus Gill	51 51
43. Rhinoptera Kuhl	51 51
69. quadriloba Le S	52
Family 23. Cephalopteride	52 52
44. Manta Bancroft	52 52
70. birostris Walb	53
Order F, Holocephali	53 53
Family 24. Chimæridæ	53
45. Chimera L.	54
\$ Chimæra	54
71. plumbea Gill	54
§ Hydrolagus Gill	54
72. colliei Benn	55
Class IV. Pisces	73
Subclass Chondrostei	82
Order G. Selachostomi	82
Family 25. Polyodontidæ	82
46. Polyodon Lae	83
73. spathula Walb	83
Order H. Glaniostomi	84
Family 26. Acipenseridæ	84
47. Acipeuser L	85
74. sturio L	85
75. transmontanus Rich	86
76. medirostris Ayres	86
77. rubicundus Le S	87
78. brevirostris Le S	87
48. Scaphirhynchops Gill	88
79. platyrhynehus Raf	88

Class IV. Pisces—continued.	Page.
Subclass Holostei	ಕರ
Order I. Ginglymodi	59
Family 27. Lepidosteidæ	89
49 (50). Lepidosteus Lac	90
§ Lepidosteus	91
80. osseus L	91
§ Cylindrosteus Raf	91
81. platystomus Raf	91
§ Atractosteus Raf. (Addenda)	92,880
82. trist@chus Bloeh & Schneider	95
Order J. Halecomorphi	95
Family 28. Amiidæ	93
51. Amia L	94
83. ealva L	94
Subclass Physostomi	94
Order K. Nematognathi	95
Family 29. Siluridæ	96
52. Noturns Raf	97
§ Schilbeodes Bleek	98
84. gyrinus Mitch	98
85. leptacanthus Jor	98
86. miurus Jor	99
87. eleutherus Jor	99
88. exilis Nels	100
89. insignis Rich	100
§ Noturus	100
90. flavus Raf	100
53. Leptops Raf. (Addenda)	
91. olivaris Raf	
54. Gronias Cope	102
92. nigrilabris Cope	102
55. Amiurus Raf	102
93. brunneus Jor.	103
94. platycephalns Grd	. 103
95. xanthocephalus Raf	104
96. melas Raf	104
97. marmoratus Holbr	104
98. catus L	104
98 (b). brachyacanthus Cope. (Addenda)	881
99. vulgaris Thomps	105
100. natalis Le S	105
100 (b). bolli Cope. (Addenda)	881
101. erebennus Jor	105
56. Ietalurus Raf	106,880
102. lophius Cope	107
103. albidus Le S	107
104. lupus Grd	107
105. niveiventris Cope	107
106. nigricans Le S. (Addenda)	
107. ponderosus Bean	108
108. punctatus Raf	108
109. fureatus C. & V	109
57. Arius C. & V	109
110 (111). felis L	110, 552
58. Ælurichthys B. & G	110
11th manipus Mitab	111

Class IV. Pisces—continued.	Page.
Subclass Physostomi. Order L. Eventognathi. (Addenda)	111 000
Family 30. Catostomide.	112
59 (60, 61). Ictiobus Raf	
§ Sclerognathus C. & V. (Addenda)	
113. cyprinella C. & V. (Addenda)	
§ Ictiobus. (Addenda)	
114. urus Ag	
115. bubalus Raf. (Addenda)	
§ Carpiodes Raf	
116. carpio Raf	
117. damalis Grd. (Addenda)	
118. thompsoni Ag	
119. bison Ag	
120. cyprinus Le S	119,883
121. difformis Cope	120,883
62. Cycleptus Raf	120
122. elongatus Le S	121
63. Pantosteus Cope	121
· 123. plebeins B. & G	122
124. delphinus Cope	122
125. bardus Cope	122
126. platyrhynchus Cope	123
127. generosus Grd	123
128. virescens Cope	124
64. Catostonns Le S	124
§ Catostomus	195
129. discobolus Cope	125
130. latipinnis B. & G.	125
130 (b). guzmaniensis Grd	126
130 (c). nebulifer Garm. (Addenda)	883
131. retropinnis Jor	126
132. longirostris Le S.	126
133. tahoensis Gill & Jor	127
§ Decactylus Raf	127
	127
134. aræopus Jor	
135. labiatus Ayr	127
136. macrochilus Grd	125
137. occidentalis Ayr	128
138. bernardini Grd	128
139. ardens J. & G	128
140. fecundus Cope & Yarrow	129
141. cypho Lock	129
142. commersoni Lac	129
143. insignis B. & G	<b>1</b> 30
144. clarki B. & G	130
§ Hypentelium Raf	<b>1</b> 30
145. nigricans Le S	<b>1</b> 30
65. Chasmistes Jor	131
§ Chasmistes	1.32
146, liorns Jor	132
§ Lipomyzon Cope	132
147. brevirostris Cope	132
148. Inxatus Cope	132

Class IV. Pisce Subclass Phys	sostomi.	Page.
Order L. E	ventognathi.	
	30. Catostomidæ.	
66.	Erimyzon Jor	132
	149. sucetta Lac	133
	150. goodei Jor	134
67.	Minytrema Jor	135
	151, melanops Raf	136
68.	Moxostoma Raf	136
	152. papillosum Cope	137
	153. velatum Cope	138
	154. bucco Cope	138
	155. pidiense Cope	138
	156. coregonus Cope	139
	157. album Cope	139
	158. thalassinum Cope	139
	159. carpio C. & V	139
	160. macrolepidotum Le S	140
	161. aureolum Le S	140
	162. crassilabre Cope	140
	163, conus Cope	141
	164. anisurum Raf	141
	165. pæcilurum Jor	141
	166. albidum Grd	141
	167. cervinum Cope	142
60	Placopharynx Cope	142
05.	168. carinatus Cope	143
70	Quassilabia Jor. & Brayt.	143
70.	169. lacera J. & B	143
Venily	31. Cyprinidæ	144
71.	Campostoma Ag	145
	170. ornatum Grd	149
	171. anomalum Raf	149
	172. prolixum Stor	150
m. )	173. formosulum Grd	150
72.	Aerochilus Ag	150
	174. alutaceus Agassiz & Pickering	150
73.	Orthodon Grd	151
	175. microlepidotus Ayr	152
74.	Lavinia Grd	152
	176. exilicanda B. & G	153
75.	Chrosomus Raf	153
	177. erythrogaster Raf	<b>1</b> 53
	178. oreas Cope	154
	179. eos Cope	154
76.	Zophendum Jor	154
	180. siderium Cope	155
	181. plumbeum Grd	155
77.	Hybognathus Ag	155
	182. nuchalis Ag	156,968
	182 (b). argyritis Grd. (Addenda)	968
	183. amarus Grd	156
	184. flavipinuis Cope	156
	185. nigrotæniatus Cope	156

Class IV. Pisces—continued. Subclass Physostomi.	Page.
Order L. Eventognathi.	
Family 31. Cyprinidæ.	
186. placitus Grd	
187. episcopus Grd	
188. fluviatilis Grd	
188 (b). punctifer Garm. (Addenda)	
189. melanops Grd	
78. Coliscus Cope	
190. parietalis Cope	
79. Pimephales Raf	
191. promelas Raf	
80. Hyborhynchus Ag	
192. confertus Grd	159
193. notatus Raf	159
194. superciliosus Cope	160
80 (b). Tirodon Hay. (Addenda)	968
194 (b). amnigenus Hay. (Addenda)	
81. Exoglossum Raf	
195. maxillingua Le S	160
82. Cochlognathus B. & G	
196. ornatus B. & G.	
197. biguttatus Cope	
83. Hemitremia Cope	
§ Hemitremia	
198. vittata Cope	
§ Chriope Jor	162
200. maculata Hay	
201. heterodon Cope	
84. Cliola Grd	
§ Miniellus Jor	
202. tuditana Cope	
203. taurocephala Hay	
204. hæmatura Cope	
205. spectruncula Cope	
206. nubila Forbes	167
207. fretensis Cope	
208. longirostris Hay	
209. straminea Cope	
210. volucella Cope	
211. microstoma Raf	
212. lineolata Ag	
213. missuriensis Cope	
214. procee Cope	169
§ Cliola	
215. vigilax B. & G	
216. chlora Jor	
§ Tiaroga Grd	
217. cobitis Grd	170
218. sima Cope	
§ Hudsonius Grd	
219. saludana Jor. & Brayt	

Class IV. Pisces—continued.	Page.
Subclass Physostomi.	
Order L. Eventognathi.	
Family 31. Cyprinidæ.	101
221. hudsonia Clint	171
222. euryopa Bean	171
§ Codoma Grd	172
223. iris Cope	172
224. jugalis Cope.	172
225. vittata Grd.	172
226. ornata Grd	173
227. callisema Jor	173
§ Moniana Grd	173
228. gibbosa Grd	174
229. forbesi Jor	174
230. leonina Grd	174
231. lutrensis B. & G	175
232. deliciosa Grd	175
233. aurata Grd.	175
234. formosa Grd.	175
§ Cyprinella Grd.	176
235. umbrosa Grd	176
236, bubalina B, & G	176
236 (b), rubripiuna Garm. (Addenda)	884
237. gunnisoni Grd	176
238. suavis Grd	176
239. lepida Grd	177
240. billingsiana Cope	177
241. macrostoma Grd	177
242. ludibunda Grd	177
243. notata Grd	177
244. venusta Grd	178
245. calliura Jor	178
246. whipplei Grd	178
§ Photogenis Cope	179
247. analostana Grd	179
♦ Erogala Jor	179
248. galactura Cope	179
249. eurystoma Jor	180
250. nivea Cope	180
251. callistia Jor	181
252. trichroistia J. & G	181
253. stigmatura Jor	183
254. cerulea Jor	182
255. chloristia J. & B	183
256. zonata Ag	183
257. xænura Jor	184
258. pyrrhomelas Cope	184
259. hypseloptera Gthr	184
85. Minnilus Raf	185
§ Luxilus Raf	186
260. cornutus Mitch	186
261. sclene Jor.	188
262. coccogenis Cope	185
ZOA. ZODISTRIS TOF	

Class IV. Pisce		Page.
Subclass Phy		
	ventognathi.	
Family	31. Cyprinidæ.	
	§ Alburnops Grd	189
	264. rosens Jor	189
	265. rubricroceus Cope	189
	266. Intipinnis Jor. & Brayt	190
	267. chlorocephalus Cope	190
	268. chiliticus Cope	191
	269. chalybæns Cope	191
	270. chrosomus Jor	191
	271. xænocephalus Jor	192
	272. plumbeolus Cope	192
	273. lacertosus Cope	192
	274. shumardi Grd	192
	275. blennins Grd	193
	276. cercostigma Cope	193
	§ ——	193
	277. ariommus Cope	194
	278. scabriceps Cope	194
	279. jejunus Forb	194
	280. leuciodus Cope	194
	281. altipinuis Cope	195
	282. amabilis Grd.	195
	283. megalops Grd	195
	284. bivittatus Cope	195
	285. timpanogensis Cope	196
	§ Lythrurus Jor	196
	286. cyanocephalus Copeland	196
	287. atripes Jor	197
	288. diplæmins Raf	197
	289. ardens Cope	198
	290. punctulatus Hay	198
	291. rnbripinnis Hay	198
	292. bellus Hay	199
		199
	293. matutinus Cope	
	294. lirus Jor	199 200
	§ Minnilus	
	296. oligaspis Cope	200
	297. umbratilis Grd	200
	298. sceptions J. & G.	200
	299. photogenis Cope	201
	300. telescopus Cope	201
	301. stilbins Jor	201
	302. percobronius Cope	202
	303, rnbelins Ag	202
	304. dinemus Raf	202
	305, rubrifrons Cope	202
	306. jemezanus Cope	203
	307. micropteryx Cope	203
86.	Protoporus Cope	203
	308. domninus Cope	204
87.	Ericymba Cope	204
	309. buccata Cope	204

Class IV. Pisces—continued.	Page.
Subclass Physostomi.	
Order L. Eventognathi.	
Family 31. Cyprinidæ.	
88. Phenaeobius Cope	205
310, teretulus Cope	205
311. mirabilis Grd	205
311 (b). seopifer Cope	205
312. catostomns Jor	206
313. uranops Cope	206
89. Rhinichthys Ag.	
314. eataractæ C. & V	207,885
315. maxillosus Cope	207,885
316. transmontanus Cope	207,885
316 (b), dulcis Grd, (Addenda)	885
317. obtusus Ag	208,885
318. atronasus Mitch	208,885
318 (b). badius Garm. (Addenda)	886
318 (e), simus Garm. (Addenda)	886
318 ( <i>d</i> ). meleagris Ag. (Addenda)	886
318 (e). arenatus Garm. (Addenda)	886
90. Agosia Grd	208
319. chrysogaster Grd	209
320. metallica Grd	209
91. Apocope Cope	209
321. carringtoni Cope	209
322. nubila Grd	210
323. vulnerata Cope	210
324. henshavii Cope	210
325. oscula Grd	211
326. ventricosa Cope	211
92. Ceratichthys Baird	211
327. biguttatus Kirt	212
328. micropogon Cope,	212
329. symmetricus B. & G.	213
330. cumingi Gthr	213
331. luceus Jor	213
332. amblops Raf	214
333. rubrifrons Jor	214
334. hypsinotus Cope	215
335. dissimilis Kirt	215
336. sterletus Cope	216
337. æstivalis Grd	216
338. gelidus Grd	216
339. labrosus Cope	217
340. zanemus Jor. & Brayt	217
341. monachus Cope	217
93. Couesius Jor	213
342. squamilentus Cope	213
343. dissimilis Grd	218
344. prosthemius Cope	219
345. physignathus Cope	219
94. Platygobio Gill	219
346. gracilis Rich	219
347. pallidus Forbes	230

Class IV. Pisces—continued,	Page.
Subelass Physostomi.	- 4-504
Order L. Eventognathi.	
Family 31. Cyprinidæ.	
95. Semotilus Raf	220
§ Semotilus	221
347 (b). corporalis Mitch	221
348. thoreauianus Jor	221
§ Leucosomus Heck	222
349. bullaris Raf	222
96. Symmetrurus Jor	222
350. argyriosus Grd	222
97. Pogonichthys Grd	223
351. macrolepidotus Ayres	223
97 (b). Stypodon Garm	223
352. signifer Garm	224
98. Mylochilus Ag	224
353. caurinus Rich	224
99. Mylopharodon Ayres	225
354. conocephalus B. & G	225
100. Ptychochilus Ag	225
355, oregonensis Rich	226
356. rapax Grd	226
357. harfordi J. & G	226
358. lucius Grd	227
101. Gila B. & G	227
359. elegans B. & G	227
360. robusta B & G	228
361. grahami B. & G	228
362. affinis Abbott	229
363. gracilis B. & G	229
364. emorii B. & G	229
365. nacrea B. & G	230
366. seminuda Cope & Yarrow	230
102. Squalins Bon	230
§ Clinostomus Grd	231
367. elongatus Kirt	232
368. vandoisulus C. & V	232
369. estor Jor. & Brayt	232
370. funduloides Grd	233
≬ Tigoma Grd	233
371. hydrophlox Cope	233
372. tænia Cope.	234
373. montanus Cope	234
374. humboldti Grd	234
375, crnorens J. & G	234
376. ardesiacus Cope	235
377. pandora Cope	235
378. margaritus Cope	235
379. gula Cope	236
380. pulcher Grd	236
381. egregius Grd	236
382. lineatus Grd	236
383. gracilis Grd	237
384. conformis B. & G	237

Class IV. Pisces—continued. Subclass Physostomi.	Page.
Order L. Eventognathi.	
Family 31. Cyprinide.	ao≈
385. bicolor Grd	
386. obesus Grd	
387. purpureus Grd	
388. pulchellus B. & G.	
389, intermedius Grd	
390. aliciæ Jouy	
391. copei J. & G	
392, niger Cope	
393, conspersus Garm	. 239
∮ Siboma Girard	. 239
394. gibbosus Ayres	. 239
§ Squalінв	. 240
395. rhomaleus J. & G	. 240,886
396. squamatus Gill	241
397. atrarius Grd	. 241,886
398. crassus Grd	. 241
§ Cheonda Grd	
399. cœruleus Grd	
400. cooperi Grd	
401. nigrescens Grd	
402. modestus Garm	
103. Phoxinus Agassiz	
403. neogæus Cope	
404. flammeus J. & G.	
405. milnerianus Cope	
<u>-</u>	
406. phlegethontis Cope	
104. Myloleucus Cope. (Addenda)	
407. tincella C. & V	
408. obesus Grd	
409. formosus Grd	
410. bicolor Grd	
411. anticus Cope	
412. boucardi Gthr	
105. Opsopæodus Hay	. 246
413. emilie Hay	. 247
106. Trycherodon Forbes	. 247
414. megalops Forbes	. 247
107. Notemigonus Raf	248
415. gardoneus C. & V	. 249
416, lucidus Grd	. 249
417. leptosomus Grd	249
418. occidentalis B. & G	250
419. chrysolencus Mitch	. 250
420. americanus L	
108. Richardsonius Girard	
421. balteatus Rich	
422. lateralis Grd	
109. Lepidomeda Cope	
423. vittata Cope	
424. jarrovii Cope	
110. Meda Girard	
425, fulgida Grd	
TAUL HIGHER CHU	- ~~~

Class IV. Pisces—continued.	Page.
Subclass Physostomi.	
Order L. Eventognathi.	
Family 31. Cyprinidæ.	
111. Plagopterus Cope	253
426. argentissimus Cope	<b>2</b> 53
112. Carassius Nilsson	253
427. auratus Linn	<b>2</b> 53
113. Cyprinus Linn	254
428. carpio L	254
Family 32. Characinidæ	254
114. Tetragonopterus Cuv	255
§ Astyanax B. & G	255
429. argentatus B. & G	255
Order M. Isospondyli	256
Family 33. Alepocephalidæ	257
115. Alepocephalus Risso	257
430. bairdii G. & B	257
Family 34. Albulide	258
116. Albula Gronov	258
431. vulpes L	258
Family 35. Hyodontidæ	259
117. Hyodon Le Sneur	259
432. alosoides Raf	259
433. tergisus Le Sueur	260
434. selenops Jor. & Bean	260
Family 36. Elopidæ	260
118. Elops L	261
435. saurus L	261
119. Megalops Lac	261
436. atlanticus C. & V. (Addenda)	262,887
Family 37. Clupeidæ	262
120. Etrnmeus Bleek	263
437. teres Dek	263
121. Spratelloides Bleeker	263
438. bryoporus Cope	264
122. Clupea L	264
§ Clupea	264
439. harengus L	265
440. mirabilis Grd	265
§ Sardinia Poey. (Addenda)	887
441. sagax Jeu	265
441 (b). pseudohispanica Poey. (Addenda)	887
§ Pomolobus Raf	265
442. chrysochloris Raf.	266
443. mediocris Mitch	266
444. vernalis Mitch	267
445. æstivalis Mitch	267
§ Alosa Cuv	267
446. sapidissima Wils	267
123. Harengula C. & V	268
447. pensacolæ G. & B	268
124. Opisthonema Gill	268
448. thrissa Osbeck	268

Order M. Isospondyli. Family 37. Clupeidæ.  125. Brevoortia Gill	Class IV. Pisces—continued. Subclass Physostomi.	Page.
Family 37. Clupeidæ.  125. Brevoortia Gill.  419. patronus Goode.  420. tyrannus Latr.  220 Family 38. Dorosomatidæ.  270 126. Dorosoma Raf  451. eepedianum Le S  451. eepedianum Le S  451. eepedianum Le S  271 451. eepedianum Le S  271 451. eepedianum Le S  272 452. irigens Jen  272 452. irigens Jen  273 453. browni Gmel  454. (b). mitchilli C. & V. (Addenda).  888 455. perfasciatus Poey  456. delicatissimus Grd  274 457. compressus Grd  274 275. compressus Grd  274 276. delicatissimus Grd  277 277 278 279 279 270 270 270 270 271 271 272 273 274 275 275 276 277 277 277 277 278 278 278 278 278 279 279 279 279 270 270 270 270 270 270 270 270 270 270		
125. Brevoortia Gill. 269 449. patronus Goode 269 440. tyrannus Latr 269 Family 38. Dorosomatida 270 126. Dorosoma Raf 271 451. cepedianum Le S. 271 451. (b). mexicanum Gthr. (Addenda) 887 Family 39. Engraulididæ 271 127. Stolephorus Lac. 272 452. ringens Jen 272 453. browni Gmel 273 454. (b). mitchilli C. & V. (Addenda) 888 455. perfasciatus Poey 273 456. delicatissimus Grd 274 457. compressus Grd 274 Family 40. Alepidosauridæ 274 128. Alepidosauridæ 274 128. Alepidosauridæ 276 458. ferox Lowe 276 459. borocalis Gill 276 459. borocalis Gill 276 Family 41. Paralepididæ 277  § Sudis Rafinesque 277 § Nudis 277 § Paralepididæ 277 § Paralepididæ 277 § Paralepididæ 277  § Paralepididæ 277  § Paralepididæ 277  § Paralepididæ 277  § Paralepididæ 277  § Paralepididæ 278 460. ringens J. & G 277  § Paralepis Risso 278 461. borocalis Reinh 278 462. coruscaus J. & G 277  § Paralepis Risso 278 Family 42. Scopelidæ 279 130. Synodus B. & S 279 130. Synodus B. & S 279 130. Synodus B. & S 279 131. Myctophum Raf 280 464. (b). intermedius Spix. (Addenda) 889 § Trackinocephalus Gill 281 465. myops Forster 281 131. Myctophum Raf 281 466. crenulare J. & G 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 Family 43. Sternoptychidæ 284 Family 44. Chaultodontidæ 284 Family 45. Stomiatidæ 285 Family 46. Family 47. Stomiatidæ 285 Family 48. Stomiatidæ 285 Family 49. Stomiatidæ 285 Family 45. Stomiatidæ 285 Family 47. Grox Reinh 285 Family 48. Stomiatidæ 285 Family 49. Stomiatidæ 285 Family 40. Rescha 285 Family 40. Rescha 285 Family 41. Chaultodontidæ 285 Family 42. Stomiatidæ 285 Family 45. Stomiatidæ 285 Family 46. Family 47. Grox Reinh 285	· ,	
449. patronus Goode. 269 450. tyrannus Latr 260. 450. tyrannus Latr 260. Pamily 38. Dorosoma Raf 270 126. Dorosoma Raf 271 451. eepedianum Le S 271 451. eepedianum Le S 271 451. (b). mexicanum Gthr. (Addenda). 887 Family 39. Engraulididæ 271 127. Stolephorus Lae 272 452. ringens Jen 272 453. browni Gmel 273 454 (b). mitchilli C. & V. (Addenda). 888 455. perfasciatus Poey 273 456. delicatissimus Grd 274 457. compressus Grd 274 458. Alepidosaurus Lowe 276 § Alepidosaurus Lowe 276 § Alepidosaurus Lowe 276 458. (b). æsculapius Bean. (Addenda). 888 § Caulopus Gill 276 459. borealis Gill 276 450. brealis Rafinesque 277 460. ringens J. & G 277 § Pamily 41. Paralepididæ. 277 460. ringens J. & G 277 § Paralepis Risso 278 461. borealis Reinh 278 462. coruscaus J. & G 277 § Paralepis Risso 278 463. Scopelidæ. 278 464. horealis Reinh 278 465. fetens Linn. 280 466. fetens Linn. 280 467. glaciale Reinh 281 468. nyops Forster 281 131. Myctophum Raf 281 466. ringens J. & G 282 467. glaciale Reinh 283 468. propostorer 284 169. Spinodus B. & S 279 130. Synodus B. & S 279 131. Synodus B. & S 279 132. Scopelidæ. 283 133. Myctophum Raf 284 1465. nyops Forster 284 134. Myctophum Raf 284 1466. crenulare J. & G 282 1467. glaciale Reinh 283 1468. Ferenulare J. & G 283 147 1481. Scopelidæ. 284 1492. Scopelidæ. 283 1494. Glaciale Reinh 285 1495. Horiotophalus Gill 284 1496. crenulare J. & G 285 1496. Joanil Bl. & Schn 284 1497. Scopelidæ. 284 1498. Joanil Bl. & Schn 284 1499. Joanil Bl. & Schn 285 1400. Frox Reinh 285 141. Stomias Cuv 286 1470. ferox Reinh 285		269
450. tyranınıs Latr. 259 Family 38. Derosomatidæ 270 126. Derosoma Raf. 271 451. cepedianum Le S 271 451 (b). mexicanum Gthr. (Addenda) 887 Family 39. Engraulididæ 271 127. Stolephorus Lac 272 452. ringens Jen 272 453. browni Gmel 273 454 (b). mitchilli C. & V. (Addenda) 888 455. perfasciatus Poey 273 456. delicatissimus Grd 274 457. compressus Grd 274 Family 40. Alepidosauridæ 274 Family 40. Alepidosaurus Lowe 276 458. ferox Lowe 276 459. borcalis Gill 276 Family 41. Paralepididæ 276 459. borcalis Gill 276 Family 41. Paralepididæ 277 460. ringens J. & G 277 ∮ Sudis Rafinesque 277 460. ringens J. & G 277 ∮ Paralepis Risso 278 461. borcalis Gilh 278 462. coruscans J. & G 278 Family 42. Scopelidæ 279 I30. Synodus B & S 279 I30. Synodus B & S 279 I30. Synodus B & S 279 I31. Myetophum Raf 281 465. myops Forster 281 I31. Myetophum Raf 283 Family 43. Sternoptychidæ 283 Family 43. Sternoptychidæ 283 Family 44. Clambodontidæ 283 Family 43. Sternoptychidæ 283 Family 43. Sternoptychidæ 284 I33. Chamliodus Bl. & Schn 284 I33. Chamliodus Bl. & Schn 285 Family 45. Stomiatidæ 284 I45. Stomias Cuv 285 I34. Stomias Cuv 286 I35. Stomias Cuv 286 I36. Family 45. Stomiatidæ 285 I34. Stomias Cuv 286 I35. Stomias Cuv 286 I36. Family 45. Stomiatidæ 285 I379 I38. Stomias Cuv 286 I39. Family 45. Stomiatidæ 285 I34. Stomias Cuv 286 I370 I38. Stomias Cuv 286 I38. Stomias Cuv 286 I39. Handrodus Bl. & Schn 285 I39. Handrodus Bl. & Schn 285 I30. Family 45. Stomiatidæ 285 I34. Stomias Cuv 286 I370 I38. Stomias Cuv 286 I38. Stomias Cuv 286 I39. Handrodus Bl. & Schn 285 I39. Handrodus Bl. & Schn 285 I30. Handrodus Bl. & Schn 285 I31. Stomias Cuv 286 I31. Stomias Cuv 286 I32. Handrodus Bl. & Schn 285 I34. Stomias Cuv 286 I370 I38. Stomias Cuv 286 I38. Stomias Cuv 286 I39. Handrodus Bl. & Schn 285 I30. Handrodus Bl. & Schn 285 I31. Stomias Cuv 286 I32. Handrodus Bl. & Schn 285 I34. Stomias Cuv 286 I36. Lower 287 I371 I381 I381		269
Family 38. Dorosomatidae       270         126. Dorosoma Raf       271         451. (e-pedianum Le S       221         451. (b). mexicanum Gthr. (Addenda)       887         Family 39. Engraulididae       271         127. Stolephorus Lae       272         452. ringens Jen       272         453. browni Gmel       273         454. (b). mitchilli C. & V. (Addenda)       888         455. perfasciatus Poey       273         456. delicatissimus Grd       274         457. compressus Grd       274         457. compressus Grd       274         Family 40. Alepidosauridae       274         128. Alepidosaurus Lowe       276         458. ferox Lowe       276         458. ferox Lowe       276         459. b. æsculapius Bean. (Addenda)       888         § Caulopus Gill       276         459. borealis Gill       276         459. borealis Gill       276         450. æsculapius Bean. (Addenda)       888         § Caulopus Gill       276         459. borealis Reine       276         460. ringens J. & G       277         § Vardis       277         § Vardis       277 <t< td=""><td></td><td>269</td></t<>		269
126. Dorosoma Raf	·	
451. cepedianum Le S	The state of the s	
451 (b). mexicanum Gthr. (Addenda) 887 Family 39. Engraulididæ 271 127. Stolephorus Lae 272 452. ringens Jen 272 453. browni Gmel 273 454 (b). mitchilli C. & V. (Addenda) 888 455. perfasciatus Poey 273 456. delicatissimus Grd 274 457. compressus Grd 274 Family 40. Alepidosaurus Lowe 276 § Alepidosaurus Lowe 276 458. ferox Lowe 276 458. (b). æsculapius Bean. (Addenda) 888 § Caulopus Gill 276 Family 41. Paralepididæ 276 Family 41. Paralepididæ 276 Family 42. Scopelidæ 277 § Sudis Rafinesque 277 § Sudis Rafinesque 277 § Paralepis Risso 278 461. borealis Reinh 278 462. coruscaus J. & G 278 Family 42. Scopelidæ 279 130. Synodus B. & S 279 463. feetens Linn 280 464. lucioceps Ayres 281 465. myops Forster 281 131. Myctophum Raf 281 465. myops Forster 284 466. Loralis Nilss 283 Family 43. Sternoptychidæ 283 Family 44. Chaulnodontdæ 284 465. borealis Nilss 284 Family 45. Sternoptychidæ 285 Family 45. Sternoptychidæ 285 Family 46. Chaulnodontdæ 284 467. glaciale Reinh 285 Family 47. Sternoptychidæ 285 Family 48. Sternoptychidæ 285 Family 49. Stomitatidæ 285 Family 47. Stomitatidæ 285 Family 48. Stomitatidæ 285 Family 47. Stomitatidæ 285		
Family 39. Engraulididæ       271         127. Stolephorus Lac       272         452. ringens Jen       272         453. browni Gmel       273         454 (b). mitchilli C. & V. (Addenda)       888         455. perfasciatus Poey       273         456. delicatissimus Grd       274         457. compressus Grd       274         Family 40. Alepidosaurus Lowe       276         § Alepidosaurus Lowe       276         458. ferox Lowe       276         459. becalasin Gill       276         450. asculapius Bean. (Addenda)       288         461. praclejis Risso       277         § Sudis       277         § Paralejis Risso       278         Family 42. Scopelidæ       279		
127. Stolephorus Lac 272 452. ringens Jen 272 453. browni Gmel 273 454. browni Gmel 273 455. perfasciatus Poey 273 456. delicatissimus Grd 274 457. compressus Grd 274 Family 40. Alepidosanride 274 128. Alepidosanrus Lowe 276 4 Alepidosanrus Lowe 276 4 Alepidosanrus Lowe 276 4 58. ferox Lowe 276 4 59. borealis Gill 276 4 59. borealis Gill 276 Family 41. Paralepididæ 277 4 60. ringens J. & G. 277 4 60. ringens J. & G. 277 4 60. ringens J. & G. 277 4 61. borealis Reinh 278 4 62. coruscans J. & G. 278 Family 42. Scopelidæ 279 130. Synodus B. & S. 279 § Synodus 280 463. fettens Linn 280 464. lucioceps Ayres 280 465. myops Forster 281 131. Myctophum Raf 281 1466. renulare J. & G. 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 Family 44. Sternoptychidæ 283 Family 44. Sternoptychidæ 283 Family 45. Sternoptychidæ 284 132. Maurolieus Cocco 283 1468. borealis Nilss 294 Family 44. Chanhodontidæ 284 133. Chanliodus Bl. & Schn 285 Family 45. Stomiatidæ 285 Family 47. Stomiatidæ 286 134. Stomias Cuv 286 135. Chanlas Cuv 286 136. Family 45. Stomiatidæ 285 134. Stomias Cuv 286 136. Family 45. Stomiatidæ 286 137. Family 45. Stomiatidæ 285 134. Stomias Cuv 286 136. Family 45. Stomiatidæ 285 137. Stomias Cuv 286 138. Stomias Cuv 286 139. Family 45. Stomiatidæ 285 134. Stomias Cuv 286 136. Family 45. Stomiatidæ 285 134. Stomias Cuv 286 136. Family 45. Stomiatidæ 285 137. Stomias Cuv 286 1470. Ferox Reinh 285		
452. ringens Jen 272 453. browni Gmel 273 454 (b). mitchilli C. & V. (Addenda) 888 455. perfasciatus Poey 273 456. delicatissimus Grd 274 457. compressus Grd 274 Family 40. Alepidosauride 274 Family 40. Alepidosaurus Lowe 276 ∮ Alepidosaurus Lowe 276 458. ferox Lowe 276 458. ferox Lowe 276 459. borealis Gill 276 Family 41. Paralepidide 277 Family 41. Paralepidide 277 ∮ Sadis 277 ∮ Sadis 277 ∮ Paralepis Risso 278 460. ringens J. & G. 277 ∮ Paralepis Risso 278 461. borealis Reinh 278 Family 42. Scopelidæ 279 Family 43. Sternoptychidæ 280 464. lucioceps Ayres 281 464. lucioceps Ayres 281 465. myops Forster 281 131. Myctophum Raf 281 465. renulare J. & G. 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 Family 44. Sternoptychidæ 283 Family 44. Chanhodontidæ 283 Family 44. Chanhodontidæ 284 Family 44. Chanhodontidæ 285 Family 45. Stomiatidæ 285 Family 47. Stomias Cuv 266 470. ferox Reinh 286		
453. browni Gmel		
454 (b). mitchilli C. & V. (Addenda)  455. perfasciatus Poey  456. delicatissimus Grd.  457. compressus Grd.  274  457. compressus Grd.  274  Family 40. Alepidosanride.  274  128. Alepidosanrus Lowe.  376  388  388  3 Lepidosanrus  276  458. ferox Lowe.  458. ferox Lowe.  458. (b). æsculapius Bean. (Addenda)  458. § Canlopus Gill.  476  459. borealis Gill.  276  Family 41. Paralepididæ.  129. Sudis Rafinesque.  377  3 Sudis.  277  460. ringens J. & G.  377  460. ringens J. & G.  462. coruscans J. & G.  278  461. borealis Reinh  462. soruscans J. & G.  278  Family 42. Scopelidæ.  279  3 Synodus  463. fetens Linn.  280  464. Incioceps Ayres  464. lucioceps Ayres  465. myops Forster.  281  281  465. myops Forster  281  281  465. myops Forster  281  281  465. myops Forster  281  281  466. crenulare J. & G.  282  467. glaciale Reinh  283  Family 43. Sternoptychidæ.  284  465. borealis Nilss  467  Family 44. Chaulodontidæ.  285  Family 45. Stomiatidæ.  286  467  469. sloani Bl. & Schn  286  469. sloani Bl. & Schn  287  469. sloani Bl. & Schn  286  470. ferox Reinh  286  470. ferox Reinh  286  470. ferox Reinh  286  470. ferox Reinh	9	
455. perfasciatus Poey 456. delicatissimus Grd		
456. delicatissimus Grd		
457. compressus Grd 274 Family 40. Alepidosauride 274 128. Alepidosauride 276 § Alepidosaurus Lowe 276 § Alepidosaurus 276 458. ferox Lowe 276 458. ferox Lowe 276 458. b. asculapius Bean. (Addenda) 588 § Caulopus Gill 276 Family 41. Paralepididæ 276 Family 41. Paralepididæ 276 Family 41. Paralepididæ 277 § Sudis Rafinesque 277 § Sudis Rafinesque 277 § Sudis Rafinesque 277 § Sudis Refinesque 277 § Paralepis Risso 278 460. ringens J. & G 277 § Paralepis Risso 278 Family 42. Scopelidæ 279 130. Synodus B. & S 279 130. Synodus B. & S 279 § Synodus 280 463. fætens Linn 280 464. Incioceps Ayres 281 464. Incioceps Ayres 281 465. myops Forster 281 131. Myctophum Raf 281 465. myops Forster 281 132. Maurolieus Cocco 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 Family 44. Chaulhodontidæ 284 133. Chauliodus Bl. & Schn 285 Family 45. Stomiat Guv 286 134. Stomiat Guv 286 134. Stomiat Guv 286 136. Forox Reinh 286	- ·	
Family 40. Alepidosaurus Lowe       274         128. Alepidosaurus Lowe       276         § Alepidosaurus       276         458. ferox Lowe       276         458 (b). æsculapius Bean. (Addenda)       888         § Caulopus Gill       276         459. borealis Gill       276         Family 41. Paralepididæ       276         129. Sudis Rafinesque       277         § Sudis       277         460. ringens J. & G       277         § Paralepis Risso       278         461. borealis Reinh       278         462. coruscaus J. & G       278         Family 42. Scopelidæ       279         130. Synodus B. & S       279         § Synodus       280         463. fætens Linu       280         464. lucioceps Ayres       281         464. lucioceps Ayres       281         465. myops Forster       281         131. Myctophum Raf       281         465. crenulare J. & G       282         467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chaulnodontidæ		
128. Alepidosaurus Lowe § Alepidosaurus — 276 § Alepidosaurus — 276 458. ferox Lowe — 276 458. b). asculapius Bean. (Addenda) — 588 § Caulopus Gill — 276 459. borcalis Gill — 276 159. Sudis Rafinesque — 277 § Sadis — 277 § Sadis — 277 460. ringens J. & G — 277 § Paralepis Risso — 278 461. borealis Reinh — 278 462. coruscaus J. & G — 278 462. coruscaus J. & G — 278 463. feetens Linu — 280 464. lucioceps Ayres — 280 464. lucioceps Ayres — 281 464. (b). intermedius Spix. (Addenda) — 889 § Trachinocephalus Gill — 281 465. myops Forster — 281 466. crenulare J. & G — 282 467. glaciale Reinh — 283 Family 43. Sternoptychidæ — 283 Family 43. Sternoptychidæ — 283 Family 43. Sternoptychidæ — 284 Family 44. Chaulnodontidæ — 284 Family 45. Stomiatidæ — 285 Family 45. Stomiatidæ — 286 470. ferox Reinh — 286		
\$ Alepidosanrus. 276 458, ferox Lowe 276 458 (b). æsculapius Bean. (Addenda) 588		
458. ferox Lowe 458 (b). æsculapins Bean. (Addenda) 588 § Caulopus Gill 776 459. borealis Gill 776 459. borealis Gill 776 459. borealis Gill 776 459. borealis Gill 777 459. Sudis Rafinesque 777 § Sudis 77 460. ringens J. & G. 777 460. ringens J. & G. 777 461. paralepis Risso 778 78 79 70 70 70 70 70 70 70 70 70 70 70 70 70	•	
458 (b). æsculapius Bean. (Addenda) 588 § Caulopus Gill. 276 459. borealis Gill 276 Family 41. Paralepididæ 276 129. Sudis Rafinesque 277 § Sudis. 277 460. ringens J. & G 277 § Paralepis Risso 278 461. borealis Reinh 278 462. coruscans J. & G 278 Family 42. Scopelidæ 279 130. Synodus B. & S 279 § Synodus 3280 463. fætens Liun 3280 464. lucioceps Ayres 281 464 (b). intermedius Spix. (Addenda) 889 § Trachinocephalus Gill 281 465. myops Forster 281 131. Myctophum Raf 281 466. crenulare J. & G 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 Family 43. Sternoptychidæ 283 Family 44. Chaulnodontidæ 284 133. Chauliodontidæ 284 134. Chaulnodontidæ 285 Family 44. Chaulnodontidæ 284 135. Chauliodos Bl. & Schn 284 169. sloani Bl. & Schn 284 169. sloani Bl. & Schn 285 Family 45. Stomiatidæ 285 134. Stomiatidæ 285 135. Cherox Reinh 386 136. Gerox Reinh 386 137. Gerox Reinh 386 138. Stomiatidæ 285 139. Stomiatidæ 285 131. Stomiatidæ 285 131. Stomiatidæ 285 133. Stomiatidæ 285 134. Stomiatidæ 285 135. Gerox Reinh 286		
\$ Canlopus Gill. 276 459. borealis Gill 276 Family 41. Paralepididæ 276 129. Sudis Rafinesque 277 \$ Sudis . 277 460. ringens J. & G. 277 \$ Paralepis Risso 278 461. borealis Reinh 278 462. coruscaus J. & G. 278 Family 42. Scopelidæ 279 130. Synodus B. & S. 279 \$ \$ Synodus 280 463. fætens Liun 280 464. lucioceps Ayres 281 464 (b). intermedins Spix. (Addenda) 889 \$ Trachinocephalus Gill 281 465. myops Forster 281 131. Myctophum Raf 281 466. crenulare J. & G 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 132. Maurolieus Cocco 283 468. borealis Nilss 284 Family 44. Chaulhodontidæ 284 133. Chauliodus Bl. & Schn 285 Family 45. Stomiatidæ 285 Family 45. Stomiatidæ 285 134. Stomias Cuv 286 470. ferox Reinh 286		
459. borealis Gill 276 Family 41. Paralepididæ 276 129. Sudis Rafinesque 277 § Sudis 277 460. ringens J. & G 277 § Paralepis Risso 278 461. borealis Reinh 278 462. coruscans J. & G 278 Family 42. Scopelidæ 279 130. Synodus B. & S 279 § Synodus 280 463. fætens Linn 280 464. lucioceps Ayres 281 464. lucioceps Ayres 281 465. myops Forster 281 131. Myetophum Raf 281 466. crenulare J. & G 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 132. Maurolieus Cocco 283 468. borealis Nilss 284 Family 44. Chauhodontidæ 284 133. Chauhiodus Bl. & Schn 285 Family 45. Stomiatidæ 285 Family 45. Stomiatidæ 285 Family 45. Stomiatidæ 285 134. Stomias Cuv 286 470. ferox Reinh 286		
Family 41. Paralepididæ       276         129. Sudis Rafinesque       277         § Sudis       277         460. ringens J. & G       277         § Paralepis Risso       278         461. borealis Reinh       278         462. coruscans J. & G       278         Family 42. Scopelidæ       279         130. Synodus       280         463. fætens Linn       280         464. lucioceps Ayres       281         464. lucioceps Ayres       281         465. myops Forster       281         465. myops Forster       281         466. crenulare J. & G       282         467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         465. borealis Nilss       284         Family 44. Chaulodontidæ       284         133. Chauliodus Bl. & Sehn       284         469. sloani Bl. & Sehn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286		
129. Sudis Rafinesque 277  § Sudis 277  460. ringens J. & G. 277  § Paralepis Risso 278  461. borealis Reinh 278  462. coruscaus J. & G. 278  Family 42. Scopelidæ 279  130. Synodus B. & S. 279  § Synodus 280  463. foetens Linn 280  464. lucioceps Ayres 281  464 (b). intermedius Spix. (Addenda) 889  § Trachinocephalus Gill 281  465. myops Forster 281  131. Myctophum Raf 281  466. crenulare J. & G 282  467. glaciale Reinh 283  Family 43. Sternoptychidæ 283  Family 44. Chauhodontidæ 284  132. Maurolieus Cocco 283  468. borealis Nilss 284  Family 44. Chauhodontidæ 284  133. Chauliodus Bl. & Schn 285  Family 45. Stomiatidæ 285  Family 45. Stomiatidæ 285  134. Stomias Cuv 286  470. ferox Reinh 286		
\$ Sudis		
460. ringens J. & G. 277		
§ Paralepis Risso       278         461. borealis Reinh       278         462. coruscans J. & G       278         Family 42. Scopelidæ       279         130. Synodus B. & S       279         § Synodus       280         463. feetens Linn       280         464. lucioceps Ayres       281         464. lucioceps Ayres       281         465. myops Forster       281         465. myops Forster       281         431. Myctophum Raf       282         466. crenulare J. & G       282         467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chaulodontidæ       284         133. Chauliodus Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286		
461. borealis Reinh       278         462. coruscans J. & G       278         Family 42. Scopelidæ       279         130. Synodus B. & S       279         § Synodus       280         463. fætens Linn       280         464. lucioceps Ayres       281         464. lucioceps Ayres       281         465. intremedius Spix. (Addenda)       889         § Trachinocephalus Gill       281         465. myops Forster       281         131. Myctophum Raf       281         466. crenulare J. & G       282         467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chanliodontidæ       284         133. Chanliodus Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286	460. ringens J. & G	
462. coruscans J. & G. 278 Family 42. Scopelidæ 279 130. Synodus B. & S. 279 § Synodus 286 463. fœtens Linn 280 464. lucioceps Ayres 281 464 (b), intermedius Spix. (Addenda) 889 § Trachinocephalus Gill 281 465. myops Forster 281 131. Myctophum Raf 281 466. crenulare J. & G 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 132. Maurolieus Cocco 283 468. borealis Nilss 284 Family 44. Chauliodon Bl. & Schn 284 133. Chauliodus Bl. & Schn 285 Family 45. Stomiatidæ 285 Family 45. Stomiatidæ 285 134. Stomias Cuv 286 470. ferox Reinh 286	♦ Paralepis Risso	
Family 42. Scopelidæ       279         130. Synodus B. & S       279         § Synodus       280         463. fœtens Linn       280         464. lucioceps Ayres       281         464 (b), intermedius Spix. (Addenda)       889         § Trachinocephalus Gill       281         465. myops Forster       281         131. Myctophum Raf       281         466. crenulare J. & G       282         467. glaciale Reinh       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chauliodontidæ       284         133. Chauliodus Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286	461. borealis Reinh	
130. Synodus B. & S. 279		278
§ Synodus 280 463, fœtens Linn 280 464, Incioceps Ayres 281 464 (b), intermedius Spix. (Addenda) 889 § Trachinocephalus Gill 281 465, myops Forster 281 131, Myctophum Raf 281 466, crenulare J. & G 282 467, glaciale Reinh 283 Family 43, Sternoptychidæ 283 132, Maurolieus Cocco 283 468, borealis Nilss 284 Family 44, Chanhodontidæ 284 133, Chanliodus Bl. & Schn 284 469, sloani Bl. & Schn 285 Family 45, Stomiatidæ 285 134, Stomias Cuv 286 470, ferox Reinh 286	Family 42. Scopelidæ	279
463. feetens Linn 280 464. Incioceps Ayres 281 464 (b). intermedius Spix. (Addenda) 889 § Trachinocephalus Gill 281 465. myops Forster 281 131. Myctophum Raf 281 466. crenulare J. & G 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 132. Maurolieus Cocco 283 468. borealis Nilss 284 Family 44. Chanhodontidæ 284 133. Chanliodas Bl. & Schn 284 469. sloani Bl. & Schn 285 Family 45. Stomiatidæ 285 134. Stomias Cuv 286 470. ferox Reinh 286	130. Synodus B. & S	279
464. Incioceps Ayres 281 464 (b). intermedius Spix. (Addenda) 889 § Trachinocephalus Gill 281 465. myops Forster 281 131. Myctophum Raf 281 466. crenulare J. & G 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 132. Maurolieus Cocco 283 468. borealis Nilss 284 Family 44. Chanhodontidæ 284 133. Chanliodas Bl. & Schn 284 469. sloani Bl. & Schn 285 Family 45. Stomiatidæ 285 134. Stomias Cuv 286 470. ferox Reinh 286	§ Synodus	280
464 (b), intermedius Spix. (Addenda).  § Trachinocephalus Gill.  465. myops Forster.  281  131. Myctophum Raf.  466. crenulare J. & G.  467. glaciale Reinh.  283  Family 43. Sternoptychidæ.  284  468. borealis Nilss.  Family 44. Chanhodontidæ.  284  133. Chanliodus Bl. & Schn.  469. sloani Bl. & Schn.  285  Family 45. Stomiatidæ.  285  134. Stomias Cuv.  286  470. ferox Reinh.	463. fætens Linn	280
§ Trachinocephalus Gill. 281 465. myops Forster 281 131. Myctophum Raf 281 466. crenulare J. & G 282 467. glaciale Reinh 283 Family 43. Sternoptychidæ 283 132. Maurolieus Cocco 283 468. borealis Nilss 284 Family 44. Chanhodontidæ 284 133. Chanliodas Bl. & Schn 284 469. sloani Bl. & Schn 285 Family 45. Stomiatidæ 285 134. Stomias Cuv 286 470. ferox Reinh 286	464. lucioceps Ayres	281
465. myops Forster       281         131. Myctophum Raf       281         466. crenulare J. & G       282         467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chauhodontidæ       284         133. Chauliodus Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286	464 (b), intermedius Spix. (Addenda)	889
131. Myctophum Raf       281         466. crenulare J. & G       282         467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chanhodontidæ       284         133. Chanliodus Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286	§ Trachinocephalus Gill	281
131. Myctophum Raf       281         466. crenulare J. & G       282         467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chaulodontidæ       284         133. Chauliodus Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286	465. myops Forster	281
466. crenulare J. & G       282         467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chaulodontidæ       284         133. Chauliodus Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286		281
467. glaciale Reinh       283         Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chauhodontidæ       284         133. Chauliodas Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286		282
Family 43. Sternoptychidæ       283         132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chaulodontidæ       284         133. Chauliodus Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286		283
132. Maurolieus Cocco       283         468. borealis Nilss       284         Family 44. Chanhodontidæ       284         133. Chanliodas Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286		283
468, borealis Nilss       284         Family 44, Chaulodontidæ       284         133, Chauliodus Bl. & Schu       284         469, sloani Bl. & Schu       285         Family 45, Stomiatidæ       285         134, Stomias Cuv       286         470, ferox Reinh       286		283
Family 44. Chauhodontidae       284         133. Chauhodons Bl. & Schn       284         469. sloani Bl. & Schn       285         Family 45. Stomiatidae       285         134. Stomias Cuv       286         470. ferox Reinh       286		284
133. Chauliodus Bl. & Schu       284         469. sloani Bl. & Schu       285         Family 45. Stomiatidæ       285         134. Stomias Cuv       286         470. ferox Reinh       286		284
469, sloani Bl. & Sehn 285 Family 45, Stomiatidæ 285 134, Stomias Cuv 286 470, ferox Reinh 286		
Family 45. Stomiatide. 285  134. Stomias Cuv 286  470. ferox Reinh 286		
134. Stomias Cuv	2004 0000000 2004 0000000 0000000000000	
470. ferox Reinh	· ·	
4.0. King King		
1.55). F.CHIOSCORIE LOWC		
471. barbatum Lowe		

Class IV. Pisces—continued.	Page.
Subclass Physostomi. Order M. Isospondyli.	
Family 45. Stomiatidae.	
136. Malacosteus Ayres.	287
472. niger Ayres.	287
•	287
137. Astronesthes Rich	288
473. niger Rich	288
Family 46. Salmonidae	289
	290
474. gra-nlandieum Reinh	
140. Mallotus Cuvier	291 291
141. Thaleichthys Girard	291
477. pacificus Rich	292
142. Osmerus Liunæus	292
478. thaleichthys Ayres	292
479. attenuatus Lock.	293
480, mordax Mitch	293
481. dentex Steind	294
143. Hypomesus Gill	294
482. pretrosus Grd	294
483. olidus Pallas	295
144. Argentina L	295
§ Silus Reinh	295
484. syrtensium G. & B.	295
145. Hyphalonedrus Goode	296
485. chalybeius Goode	296
146. Coregonus Linnæus	296
§ Prosopi m Milner	297
486 (487). williamsoni Grd	297
488. quadrilateralis Rich	298
489. kennicotti Milner	298
§ Coregonus	299
490. clupeiformis Mitch	299
491. labradoricus Rich	299
492. hoyi Gill	299
§ Arg. jrosomus Ag	300
493. merki Gthr	300
493 (b). laurettæ Bean. (Addenda)	889
494. artedi Le S	301
495. nigripinnis Gill	301
§ Allosomus Jor	301
496, tullibee Rich	301
147. Thymallus Cuv	302
497. signifer Rich	302
148. Stenodus Rich	304
498. mackenzii Rich	304
149. Oncorhynchus Suckley.	304
499. gorbuscha Walb	305
500, keta Walb	305
501. tchawytcha Walb. (Addenda)	,
502. kisutsch Walb	307
503. nerka Walb	308
150. Salmo Ĺ	309

Class IV. Pisces—continued. Subclass Physostomi.	Page.
Order M. Isospondyli.	
Family 46. Salmonidæ.	
§ Salmo	311
504. salar L.	311
§ Fario C, & V	312
•	312
505, irideus Gibbons	313
506. gairdneri Rich	
507. spilurus Cope	314 314
508. purpuratus Pall	
151. Salvelinus Rich	816
§ Cristiconer Gill & Jor	317
509, namayeush Walb	317
§ Salvelinus	318
510 (511). oquassa Grd	318
512. arcturns Gthr	319
513. malma Walb	319
514 (515). fontinalis Mitch	320
516. rossi Rich	321
517. nitidus Rich	321
518. stagnalis Fabr	321
Family 47. Percopside	322
152. Percopsis Ag	322
519. guttatus Ag	355
Order N. Haplomi	323
Family 48. Amblyopside	323
153. Amblyopsis De K	324
520. spelæus De K	324
154. Typhlichthys Girard	324
521. subterraneus Grd	395
155. Chologaster Agassiz	325
522. cornutus Ag	325
523. agassizi Putnam	325
523 (b), papillifer Forbes. (Addenda)	325, 890
Family 49. Cyprinodontidæ	326
156. Jordanella G. & B.	327
524, floridæ G. & B	328
157. Cyprinodon Lac	328
525. variegatus Lac	329, 890
526. boviuns B. & G. (Addenda)	890
526 (b). eximius Grd. (Addenda)	890
527. latifasciatus Garm	329
528. elegans B. & G.	329
529. californiensis Grd.	330
530. macularias B. & G	330
531. carpio Gthr	330
158. Fundulus Lac	
§ Hydrargyra Lac	
532, majalis Walb	
533. swampinns Lac.	332
534. similis B. & G.	
535, zebrinus J. & G. (Addenda)	323 801
536. parvipinnis Grd	333
ooo. parvipums ora	1,1,0

Class IV. Pisces—continued. Subclass Physostomi.	Page.
Order N. Haplomi.	
Family 49. Cyprinodontide.	
§ Fundulus	334
537. seminolis Grd	332
538, diaphanus Le S.	* 334
539, confluentus G. & B	334
540. menona Jor. & Copel	335
541. adinia J. & G	335
542. nigrofasciatus Le S	335
542 (b). ocellaris J. & G. (Addenda)	891
543. heteroclitus L	336
543 (b). grandis B. & G. (Adden da)	891
♦ Xenisma Jor	336
544. catenatus Storer	337
545. stellifer Jor	337
§ Adinia Grd. (Addenda)	892
545 (b), xenicus J. & G. (Addenda)	892
159. Zygonectes Ag	338
546. rubrifrons Jor	338
547. henshalli Jor	338
548. floripinnis Cope	339
549. lineatus Garm	339
550. notatus Raf	339
552. inurus J. & G. (Addenda)	
553. dispar Ag	341
553 (b). craticula G. & B. (Addenda)	892
	341
554. brachypterus Cope	342
555. sciadicus Cope	
556. chrysotus Gthr	342
557. zonatus Mitch	342
558. cingulatus C. & V	342
160. Lucania Girard	342
559. vennsta Grd	
560. parva B. & G	<b>343,</b> 893
561. goodei Jor	343
161 Gambusia Poey	344
562 (563) (565). patruelis B. & G	345, 893
564. arlingtonia G. & B	345
566. nobilis B. & G	346
566 (b), senilis Grd. (Addenda)	894
162. Mollienesia Le Sueur	346
567. latipinna Le S	347,894
567 (b). lincolata Grd. (Addenda)	894
163. Pœcilia Bl. & Schn	347
568, conchiana Grd	348
164. Girardinus Poey	348
569. formosus Grd.	349
570. occidentalis B. & G.	349
Family 50. Umbrida	349
165. Umbra Müller	350
571. limi Kirt	350
166. Dallia Bean	350
572. pectoralis Bean	351

## TABLE OF CONTENTS.

Class IV. Pisces—continued.	Page.
Subclass Physostomi.	
Order N. Haplomi.	
Family 51. Esocida	351
167. Esox L	352
§ Picorellus Raf	352
573. americanus Gmel	352
574. umbrosus Kirt. (Addenda)	352,894
575. reticulatus Le S	353
§ Esox.	353
• 576. lucins Linu	353
§ Mascalongus Jor	353
577. nobilior Thompson	353
Order O. Apodes	354
Family 52. Muraenidae	355
168, Murana Linu	355
168. Muræna Linn § Muræna	355
\ \Muran \( \text{Muran (C. 1. 6. D (Addanda)} \)	894
578. retifera Goode & Bean. (Addenda)	
§ Sidera Kaup. (Addenda)	356
579. mordax Ayres	356
580. ocellata Agassiz	895
580 (b). afra Bloch. (Addenda)	
580 (c). moringa Cuv. (Addenda)	895
Family 53. Anguillidæ	35 <b>7</b>
168 (b). Letharchus Goode & Bean. (Addenda)	896
580 (b). velifer Goode & Bean. (Addenda)	896
169. Cœcula Vahl	358
§ Callechelys Kanp. (Addenda)	050
581. scuticaris G. & B	358
581 (b). t-res Goode & Bean. (Addenda)	897
170. Murænopsis LeS. (Addenda)	358, 969
582. morday Poey. (Addenda)	897
583. triserialis Kaup	359, 897
583 (b). macrurus Poey. (Addenda)	898
583 (c), chrysops Poey. (Addenda)	. 898
584 ocellatus Le S	. 359
170 (b). Ophichthys Ahl. (Addenda)	. 899, 969
584 (b), longus Poey. (Addenda)	. 899
171. Myrichthys Girard	. 360
585, tigrinus Grd	. 360
171 (b). Myrophis Lütken. (Addenda)	. 899
585 (b), lumbricus J. & G. (Addenda)	. 899
585 (c). microstigmius Poey. (Addenda)	900
172. Neoconger Girard	360
586, mucronatus Grd	360
173. Anguilla Thunberg	. 361
587. rostrata Le S	. 361
174. Leptocephalus Gmelin. (Addenda)	. 362, 969
588, conger L. (Addenda)	. 362, 969
588 (b), caudicula Bean. (Addenda)	. 900
175. Simenchelys Gill	36:
589. parasiticus Gill	36
559, parasureus om	
Family 54. Synaphobranchidae	•
176. Synaphobranchus Johnson	

Class IV. Pisces—continued.	Page.
Subclass Physostomi.	
Order O. Apodes.	
Family 55. Saccopharyngidæ	365
177. Saccopharynx Mitch	365
591. flagellum Mitch	365
Family 56 (a). Nemichthyidæ	365
178. Nemichthys Rich	360
592, scolopaceus Rich	366
593. avocetta J. & G	367
Sub-class Physoclisti	367
Order P. Opisthomi	368
Family 56 (b). Mastacembelidæ	368
179. Ptilichthys Bean	369
594. goodei Bean	369
Family 56, (c). Notacanthidæ	370
180. Notaeanthus Bloch	370
595, chemnitzi Bloch	370
595 (b). phasganorus Goode. (Addenda)	900
Order Q. Synentognathi	371
Family 57. Scomberesocidæ	371
181. Tylosurus Cocco	372
596. hians C. & V	373,901
597. caribbæus Le S. (Addenda)	<b>373, 901</b>
598. notatus Poey	373
599, marinus Bl. & Schn. (Addenda)	374,902
600. exilis Grd	374
600 (b), gladius Bean, (Addenda)	901
182. Scomberesox Lac	374
601. saurus Walb	375
602. brevirostris Peters	375
183. Hemirhamphus Cuvier	376
§ Hemirhamphus	376
603. unifasciatus Ranz	376
604. rosie J. & G	376
604 (b). brasiliensis L. (Addenda)	902
§ Euleptorhamphus Gill	
605, longirostris Cuv	377
183 (b). Chriodorus Goode & Bean. (Addenda)	903
605 (b). atherinoides Goode & Bean. (Addenda)	908
184. Halocypselus Weinland	377
606. evelans Linn	377
C07. obtusirostris Gthr	378
185. Exocetus L	378
607. (b). hillianus Gosse. (Addenda)	903
608, californicus Cooper	379
610. noveboracensis Mitch. (Addenda)	904
611. exiliens Gmel	
186. Cypselurus Swainson 612. furcatus Mitch	380
613. comatus Mitch	380
Order R. Lophobranchii	381 381
Family 58. Syngnathidae	382
187. Siphostoma Raf	382,905
	- JULY 000

Class IV. Pisces—continued.	Page.
Suhclass Physoclisti.	
Order R. Lophobranchii.	
Family 58. Syngnathidae.	
§ Siphostoma	383
614. fuscum Stor	
614 (b), affinis Gthr	383,904
615. louisianæ Gthr	383,906
615 (b), floridæ J. & G. (Addenda)	905
616. californiense Stor	384,906
616 (b). griseolineatum Ayr. (Addenda)	905
616 (c). bairdianum Dum. (Addenda)	905
617. leptorhynchus Grd	384,906
617 (b). auliscus Swain. (Addenda)	384,905
§ Dermatostethus Gill	385
618. punctipinne Gill	385,905
§ Corythrichthys Kaup. (Addenda)	906
618 (b), zatropis J. & G. (Addenda)	906
Family 59. Hippocampidae	385
188. Hippocampus Raf	386
619. heptagonus Raf	386
619 (b), punctulatus Guich. (Addenda)	907
619 (c), hudsonins Dek. (Addenda)	907
619 (d). stylifer J. & G. (Addenda)	907
619 (e). zostera J. & G. (Addenda)	907
620. ingens Grd	386
Order S. Hemibranchii	387
Family 60. Centriscidæ	387
189. Centriscus L	388
621. scolopax L	358
Family 61. Fistulariidæ	388
196. Fistularia Linn	389
622. tabaccaria L	389
623. serrata Cuv	390
Family 62. Aulostomatide	390
191. Aulostoma Lacépède	390
624. maeulatum Val	390
Family 63. Aulorhynchida	391
192. Aulorhynchus Gill	391
625. flavidus Gill	391
Family 64. Gasterosteidæ	392
193. Gasterostens L	393
§ Pygosteus Brev	393
626. pungitius L	393
§ Eucalia Jor	394
627. inconstans Kirt	394
§ Gasterosteus	394
628. microcephalus Grd	
629. biaenleatus Shaw	395
630. atkinsii Bean	395
631. aculeatus L	
631 (b). cataphractus Pall	
194. Apeltes Dek	396
632. quadracus Mitch	396

Class IV. Pisces—continued. Subclass Physoclisti.	Page.
Order T. Acanthopteri	397
	401
Family 65. Mugilidæ	403
	40:
634 (633). albula L.	40:
635. brasiliensis Ag Family 66. Atherinide	404
·	403
196. Atherina L	403
636, carolina C. & V.	403
637. veliana G. & B.	403
197. Leuresthes J. & G.	403
638. tennis Ayres	
198. Labidesthes Cope	40€
639. sicculus Cope	406
199. Menidia Bonap	
640. laciniata Swain. (Addenda)	407, 908
641. vagrans G. & B	407
642. notata Mitch	407
742 (b). audens Hay. (Addenda)	908
643. beryllina Cope	408
644. besci C. & V. (Addenda)	
645. peninsulæ G. & B	408
200. Atherinopsis Grd	409
646. californiensis Grd	409
* 201. Atherinops Steind	409
647. affinis Ayres	409
Family 67. Sphyrænidæ	410
202. Sphyræna Bloch	410
648. argentea Grd	41
649. spet Haüy	411
650. gnaguancho C. & V	41
650 (b). picuda Bl. & Sehn	415
Family 68. Polynemidæ	413
203. Polynemus Linn	41:
650 (c). plumieri Lac	41:
650 (d). octofilis Gill	41:
651. octonemus Grd,	41:
Family 69. Ammodytidæ	41.
204 (205). Ammodytes L	414, 909
652 (653, 656?). americanus DeK414,	
654. alascanus Cope	415
655. dubins Reinh	415
Family 70. Echeneididæ	416
206. Echeneis L	416
657. naucrates L	410
206 (b). Phthirichthys Gill	969
657 (b). lineatus Menzies. (Addenda)	969
206 (c). Remora Gill. (Addenda)	417, 909
658. squalipeta Dald. (Addenda)	
659. brachyptera Lowo	417
207. Rhombochirus Gill	417
660. ostcochir Cuv	418
Family 71. Elacatidæ	418
208. Elacate Cuv	418
661. canada L	41.

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 72. Xiphiida	419
209, Xiphias L	419
662. gladius L	420
210. Tetrapturus Raf	420
663, indicus C. & V. (Addenda)	420,909
664. [amplus Poey]	420
211. Histiophorus Lacepede	421
665. gladius Brouss	431
Family 73. Trichinridae	421
212. Trichiurus L	422
666. lepturns L	422
212 (b). Benthodesmus G. & B. (Addenda)	910
666 (b). elongatus Clarke. (Addenda)	910
Family 74. Scombridae	422
213, Seomber L	423
667. pneumatophorus Delaroche	424, 910
667 (b). colias Gmel. (Addenda)	910
668. scombrus L	424
214. Auxis Cuvier	424
669. thazard Lac. (Addenda)	425, 911
215. Scomberomorus Lac	425
670, concolor Lock	425
671. maculatus Mitch	426
672. regalis Bloch	426
673. caballa C. & V	427
216. Sarda Cuvier	427
674. mediterranea Bl. & Schn	427
675. chilensis C. & V	428
217. Oreynus Cuv	428
676. alalonga Gmel	428
677. thynnus L	429
218. Euthynnus Lütken	429
678. alliteratus Raf	430
679, pelamys L	430
Family 75. Carangida	430
219. Trachurus Raf	431
680. picturatus Bowd. (Addenda)	
681. saurus Rač	439, 911
220, Decapterus Bleek	432
682, punetatus Ag	
683, macarellus C, & V	433
221. Caranx Lac	
684. crumenophthalmus Bloch	
685. chrysus Mitch. (Addenda)	435
686. caballus Gthr	
687. cibi Poey	
688. beani Jor	
689. amblyrhynchus C, & V. (Addenda)	
690, fallax C, & V	437
691. hippos L	
222. Blepharis Cuv	
692. crinitus Akerly	400

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 75. Carangidæ.	
223. Selene Lac	439
♦ Selen€	439
693. vomer L	439
§ Fomer Cuv	440
694. setipinnis Mitch	440
224. Chloroscombrus Grd	440
695. chrysurus L	441
225. Trachynotus Lac	441
696. carolinas L	442
697. ovatus L	44:
693. goreensis C. & V	449
699. glaneus Bloch	
226. Naucrates Raf.	449
700. ductor L.	44:
227. Seriola Cuv	444
701, dorsalis Gill. (Addenda)	
701 (b). lalandi C. & V. (Addenda)	912
702, rivoliana C. & V.	444
702 (b). falcata C. & V. (Addenda)	913
703. earolinensis Holb. (Addenda)	
704. zonata Mitch	445
705. fasciata Bloch	445
228. Elagatis Benn	440
706. pinnulatus Poey	440
229. Oligoplites Gill. (Addenda)	446, 913
707. occidentalis L	447
Family 76. Pomatomidæ	447
230. Pomatomus Lac	448
708. saltatrix L	448
Family 76 (b). Nomeidæ	448
231. Nomeus Cuv	449
709. gronovii Gmel	449
Family 77. Stromateidæ	449
232. Stromateus L.	450
§ Rhombus Lac	451
710. paru L. (Addenda)	
§ Stromateus	451
711. simillimus Ayres.	451
§ Poronotus Gill.	451
712. triacauthus Peck	451
	459
233. Lirus Lowe.	
713. perciformis Mitch	459
Family 78. Lampridide	45
234. Lampris Retz	453
714. guttatus Briin	45:
Family 79. Coryphænidæ	45
235. Coryphena L	45
715. equisetis L. (Addenda)	
716. hippurus L. (Addenda)	
Family 80. Bramid:e	45
236. Pteraclis Grouow	45
717. carolinus C. & V	458

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 80. Bramidæ.	
236 (b). Brama Bloch & Schn. (Addenda)	915
717 (b). raji Bloch. (Addenda)	915
Family 81. Zenidae	456
237. Zenopsis Gill	456
718. ocellatus Storer	457
Family 82. Beryeida	457
238. Hoplostethus C. & V	458
719. mediterraneus C. & V.	458
239. Holocentrum Bloch	459
720. pentacanthum Bloch	459
Family 83. Aphredoderidæ	460
240. Aphredoderns Le S	46t
721. sayanns Gilliams	460
Family 83 (b). Elassomatidæ.	461
241. Elassoma Jordan	461
722. zonatum Jor	
Family 84. Centrarchidae	
242. Centrarelius C. & V.	462
723. macropterns Lac.	463
	463
243. Pomoxys Raf	464
724. annularis Raf	464
725. sparoides Lac	465
244. Archoplites Gill	465
726. interruptus Grd	466
245. Ambloplites Raf	466
727. rupestris Raf	466
246. Chænobryttus Gill.	467
728. antistins McKay	467
729. gnlosus C. & V	468
247. Acantharchus Gill	468
730. pomotis Baird	469
248. Enneacanthus Gill	469
731. eriarchus Jor	469
732. obesus Baird	470
733. gloriosus Holbr	470
734. simulans Cope	470
249. Mesogonistins Gill	471
735. chætodon Baird	471
250. Lepomis Raf	472
♦ Apomotis Raf	473
736. eyanellus Raf	473
737. symmetricus Forbes	473
738. phenax Cope & Jor	474
§ Lepomis	474
739. ischyrns Jor. & Nelson	474
740. macrochirus Raf	475
741. mystacalis Cope	475
742. elongatus Holbrook	475
743. mnrinus Grd	475
744. punctatus C. & V	476
Bull, Nat. Mus. No. 16——III	

Class IV. Pisces—continued.	Page.
Subclass Physoelisti.	
Order T. Acanthopteri.	
Family 84, Centrarchidæ.	
745. miniatus Jor	476
746. auritus Linn	477
747. megalotis Raf	477
748. marginatus Holbr	478
749. bombifrons Ag	478
§ Helioperca Jordan	479
750, humilis Grd	479
751. pallidus Mitch	479
§ Xystroplites Jor	480
752. heros B. & G	480
753. euryorus McKay	481
754. albulus Grd	481
§ Eupomotis Gill & Jor	482
755. holbrooki C. & V	482
756. notatus Ag	482
757. gibbosus L	482
758. lirus McKay	483
251. Micropterus Lac	484
759. saluoides Lac	454
760. dolomiei Lac	485
Family 85. Percide	486
252. Ammocrypta Jor	488
761. beani Jor	489
762. pellucida Baird	489
762 (b). vivax Hay. (Addenda)	970
763. asprella Jor	490
253. Ioa Jor, & Bray	490
764. vitrea Cope	490
764 (b). vigilis Hay. (Addenda)	971
254. Boleosoma DeKay	491
765. olmstedi Storer	492
766. nigrum Raf	493
767. effulgens Grd	493
768. vexillare Jor	493
769. æsopus Cope	493
255. Vaillantia Jor	493
770 (771). camura Forbes	494
256. Ulocentra Jor	494
772. phlox Cope.	495
773. stigmæa Jor	495
774. atripinnis Jor	495
775. simotera Cope	496
257. Diplesium Raf	496
776. bleunioides Raf	497
258. Cottogaster Putnam	497
777. copelandi Jor	498
778. putnami J. & G	498
259. Imostoma Jordan.	498
779. shumardi Grd	498
260. Pereina Haldeman	499
780. caprodes Raf	499

Class IV. Pisces—continued. Subclass Physoelisti.	Page.
Order T. Acanthopteri.	
Family 85. Percidæ.	
261. Alvordins Girard	500
781. macrocephalus Cope	501
782. phoxocephalus Nelson	501
783. aspro Cope & Jor	501
784. nevisensis Cope	502
785. erassus Jor. & Brayt	503
786. variatus Kirt	503
787. evides Jor. & Copel	503
788. fasciatus Grd	504
262. Hadropterus Ag	505
789. aurantiacus Cope	506
790. nigrofasciatus Ag	506
263. Nothonotus Agassiz	506
791. camurus Cope	50G
792. sanguifluus Cope	507
793. maculatus Kirtl	508
794. rufilineatus Cope	508
795. vulueratus Cope	508
796. tessellatus Storer	509
797. cinereus Storer	509
264. Nanostoma Putnam	509
798. zonale Cope	510
799. elegans Hay	510
800. thalassinum Jor. & Brayt	511
801. tessellatum Jor	511
802. inscriptum Jor. & Brayt	513
265. Etheostoma Raf	512
803, lineolatum Ag	513
804. flabellare Raf	513
805. squamiceps Jor	514
266. Pecilichthys Ag	514
§ Pacilichthys	515
806. virgatus Jor	515
807. saxatilis Hay	515
808. punctulatus Ag	516
809. artesiae Hay	516
810. lepidus B. & G	517 517
812. spectabilis Agassiz.	518
813. asprigenis Forbes	518
814. jessia Jor. & Brayt.	518
ý Boleichthys Grd	519
815. butlerianus Hay	519
816. barrattii Holbr.	519
817. fusiformis Grd	520
818. erochrous Cope	520
819. cos Jor. & Copel	520
820. exilis Grd	521
821. warreni Grd	521
822. gracilis Grd	521
§ Alrarius Grd	522
823. lateralis Grd	522

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 85. Percidæ.	<b>=</b> 20
267. Microperca Putnam	522
824. prœliaris Hay	
825. punctulata Putnam	
268. Perca Linu	523
826. americana Schranck	524
269. Stizostedium Raf	
827. vitreum Mitch	
828. canadense Smith	
Family 86. Serranide	
270. Centropounus Lac	527
829. undecimalis Bloch	527
271. Roccus Mitch	527
§ Roccus	529
830. lineatus Bloch	529
831. chrysops Raf	529
≬ Morone Gill	530
832. interruptus Gill	530
833. americanus Gmel	530
272. Stereolepis Ayres	531
834. gigas Ayres	531
273. Polyprion Cuvier	532
835. oxygenius Bl. & Schn	532
273 (b). Creolus J. & G. (Addenda)	916, 972
835 (b). furcifer C. & V. (Addenda)	916
274. Serranus Cuv	532
♦ Centropristis Cuv	533
836. atrarius L	533
836 (b). nigrescens Bl. & Schn. (Addenda)	916
837. trifureus L	534
§ Diplectrum Holbr	534
838. formosus L. (Addenda)	
§ Prionodes Jen. (Addenda)	
839. subligarius Cope	
§ Paralabrax Grd	535
840. clathratus Grd	535
841. maculofasciatus Steind	536
842. nebulifer Grd	536
274 (b). Hypoplectrus Gill. (Addenda)	
843. mgricans Poey. (Addenda)	
275. Trisotropis Gill.	537, 517
814. stomias Goode & Bean. (Addenda)538.	
	, 510, 571 538
845. falcatus Poey 846. microlepis G. & B	538 538
	918
846 (b). petrosus Poey. (Addenda)	539
847. atlanticus Lac. (Addenda)	
848. drummond-hayi G. & B. 849. morio Cuv	540
	540
850 (853?), nigritus Holbr	540
850 (b). striatus Bloch. (Addenda)	918

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 86. Serranidæ.	
851. niveatus C. & V	541
853. ? guasa Poey (nigritus?)	542, 920
276 (b). Bodianus Bloch	541, 919
852. punetatus L	541
852 (b). tæmops C. & V. (Addenda)	919
278. [Dules Cuvier]	542
854. [auriga C. & V.]	542
279. Rhypticus Cuvier	543
§ Promicropterus Gill	543
855. maculatus Holb	543
856. [nigripinnis Gill.] (Addenda)	
857. pituitosus G. & B	543
Family 87. Priacanthide	544
280. Priacanthus Cuv	544
♦ Priacanthus	544
·	
858. arenatus C. & V. (Addenda)	545
§ Pseudopriacanthus Bleek	
859. altus Gill	545
Family 88. Sparida	545
281. Xenistius J. & G. (Addenda)	
860. californiensis Steind	
282. Lutjanus Bl. & Schn	547
♦ Ocyurus Gill	548
S61. chrysurus Bloch. (Addenda)	
§ Lutjanus	548
862. caxis Bl. & Schn	548
862 (b). caballerote Bl. & Schu. (Addenda)	921
862 (c). campechianus Poey. (Addenda)	549,921
863. blackfordi G. & B	549
864. stearnsi G. & B	549, 922
864 (b). synagris L. (Addenda)	955
§ Rhomboplites (ii)	549
865. aurorubens C. & V	549
282 (b). Conodon C. & V. (Addenda)	550, 923
866. nobilis L	
283. Pomadasys Lac	55.0
§ Orthopristis Grd	
867 (868). fulvomaculatus Mitch	_
§ Anisotremus Gill. (Addenda)	
869. davidsoni Steind	
870. virginicus L.	
871. bilineatus C. & V	
871 (b). interruptus Gill. (Addenda)	1923
284. Diabasis Desm	
872. plumieri Lac. (Addenda)	
872 (b), elegans C. & V. (Addenda)	
873. chrysopterus L	
873 (b), chromis Brouss. (Addenda)	
873 (c), albus C, & V. (Addenda)	
874. fremebandus G. & B	
874 (b). jeniguano Poey. (Addenda)	
875. trivittatus Bl. & Schn	554

lass IV. Pisces—continued.	Page,
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 88. Sparidæ.	
285. Lobotes Cnv	554
876. surinamensis Bloch.	555
285 (b). Calamus Sw. (Addenda)	925
876 (b), megacephalus Sw. (Addenda)	926
876 (c). bajonado Bl. & Schn. (Addenda)	926
876 (d). macrops Poey. (Addenda)	927
876 (c). arctifrons Goode & Beau. (Addenda)	927
876 (f). medius Poey. (Addenda)	928
877 milneri G, & B. (Addenda)	556, 925
286. Sparus L	550
§ Pagrus Cuv	550
878. pagrus L	
286 (b). Stenotomus Gill. (Addenda)	
880. chrysops L.	
881. versicolor Mitch. (Addenda)	
881 (b). caprinus Bean. (Addenda)	950
286 (c). Lagodon Holbr. (Addenda)	
882. rhomboides L	อิอิธ
287. Diplodus Raf	
≬ Archosargus Gill	558,920
883. probatocephalus Walb	558
§ Diplodus	559
884 (885), holbrooki Bean	559
885 (b). caribbæus Poey, (Addenda)	930
288. Girella Gray	560
886. nigricans Ayres	560
289. Cyphosus Lacèpéde (Addenda)	560,972
887. bosqui Lac	561
290. Scorpis Cuv. & Val.	568
≬ Cæsiosoma Kaup	565
888. californiensis Steind	569
Family 89. Apogonidæ	56:
219. Apogon Lac	562
§ Apogon	56:
[889. americanus Castelnau]	56:
889 (b). maculatus Poey. (Addenda)	930
§ Apogonichthys Bleek. (Addenda)	931
889 (c). alutus J. & G	931
§ Glossamia Gill	564
890. pandionis G. & B	564
Family 90. Mullida	564
292. Mullus L	564
891. barbatus L	565, 931
293. Upeneus Cuvier	565
§ Pseudupeneus Bleek	565
892. maculatus Bloch	565
Family 91. Sciænidæ	566
294. Haploidonotus Raf	567
893. grunniens Raf	567
295. Pogonias Lae	568
894. chromis Linn.	568

583

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 91. Scienidie.	
296. Sciana L	569
§ Stelliferus Stark	569
895. lanceolata Holbr. (Addenda)	569, 931
§ Bairdiella Gill	570
896. Chrysura Lac. (Addenda)	, 931, 933
§ Ophioscion Gill	,,
897. jacobi Steind	571
§ Sciana	
898. ocellata L	571
296. (b.) Roneador J. & G. (Addenda)	
	572
899. stearnsi Steind.	
296 (c.) Corvina Cuv. (Addenda)	932
§ Corrina	572
900, saturna Grd	572
♦ Pareques Gill	573
901. acuminata Bl. & Schn	573
296. (d). Eques Bloch. (Addenda)	935
901 (b). lanceolatus Gmel. (Addenda)	932
297. Liostomus Lac	573
902. xanthurus Lae	574
298. Genyonemus Gill	574,932
903. lineatus Ayres	574
299. Micropogon Cuv. & Val	575
904. undulatus L	575
300. Umbrina Cuvier	575
905. roncador J. & G.	576
906. broussoneti C. & V	
301. Meuticirrus Gill	576
907. nebulosus Mitch	
908. littoralis Holbr	
909. alburnus L	
910. undulatus Grd	
302. Larimus Cuv. & Val 911. fasciatus Holb	
303 (304). Cynoscion Gill	
§ Atractoscion Gill. (Addenda)	
912. nobile Ayres.	
§ Cynoscion	
913. parvipinne Ayres	
914. nothum Holb	
915. regale Bl. & Schn	
916. thalassimum Holb	
917. maculatum Mitch	
205. Scripkus Ayres	
918. politus Ayres	589
Family 92. Gerridae	589
306. Gerres Cuvier	
♦ Gerres	
919. plumieri C. & V	. 583
919 $(b)$ . olisthostoma Goode & Bean. (Addenda)	934
§ Diapterus Ranz	
•	

Class IV. Pisces—continued. Subclass Physoclisti.	Page.
Order T. Acanthopteri.	
Family 92. Gerridæ.	
920. gula C. & V. (Addenda)	584 994
921. homonymus Goode & Bean	584
921 (b). cinereus Walb. (Addenda)	935
922. harengulus Goode & Bean	584
Family 93. Embiotocidæ	585
307. Hysterocarpus Gibbons	586
923. traski Gibbons	587
308. Abeona Girard	587
924. minima Gibbons	587
925. aurora Jor. & Gilb	588
308 (b). Brachyistius Gill. (Addenda)	
926. frenatus Gill	589
927. rosaceus Jor. & Gilb	589
309. Micrometrus Gibbons.	58s
928. aggregatus Gibbons	590
310. Holconotus Agassiz. (Addenda	
	590, 536
§ Hypocritichthys Gill	591
929. analis A. Agassiz	591 591
§ Hyperprosopon Gibb	
930. argenteus Gibbons. (Addenda)	591
931. agassizii Gill	592
§ Holconotus Ag	592
932. rhodoterus Agassiz.	592
310 (b). Amphistichus Agassiz	593
933. argenteus Agassiz	593
311. Hypsurus A. Agassiz	593
934. caryi Agassiz	593
312. Ditrema Schlegel	594
♦ Embiotoca Ag	594
935. laterale Agassiz	594
936. jacksoni Agassiz	595
$\delta$ Ditrema	595
937. atripes Jor. & Gilb	595
938. furcatum Grd	596
313. Rhachochilus Agassiz	596
939. toxotes Agassiz	596
314. Damalichthys Grd	597
940. argyrosomus Grd	597
Family 94. Labridæ	597
315. Ctenolabrus Cuv. & Val	599
§ Tautogolubrus Gthr	599
941. adspersus Walb	599
316. Hiatula Lac. (Addenda)	599, 936
942. onitis Linn	600
317. Lachnolæmus Cuv. & Val	600
943. falcatus Linn	601
318. Harpe Lacépède	601
944. rufa Linn	601
318 (b). Trochocopus Gthr. (Addenda)	602,936
♦ Pimelometopon Gill	605
945. pulcher Ayres	605

of DV D' as autimed	Page.
Class IV. Pisces—confinued.	
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 94. Labridæ.  31s. Platyglossus Blecker	605
946. radiatus Linu	603
947, 948. bivittatus Bloch. (Addenda)	603, 936
948 (b). caudalis Pocy. (Addenda)	937
949. semiciuctus Ayres	603
320. Pseudojulis Blecker	604
§ Oxygulis Gill	°604
950. modestas Grd	604
950, modestas tra	605
321. Xyrichthys Cuv. & Val	605
951. vermiculatus Poey	605
952. lineatus Cuv. & Val	606
322. Calliodon Gronow	606
953. ustus Cuv. & Val.	
323. Scarus Forsk. (Addenda)	200, 250 202 023
§ Scarus. (Addenda)	607
954. guacamaia Cuv. and Val	
954 $(b)$ . croicensis Bloch. (Addenda)	938
§ Sparisoma Sw. (Addenda)	938
954 (c). squalidus Poey. (Addenda)	938
954. (d). radians C. & V. (Addenda)	939
Family 95, Cichlidae	607
324. Heros Heckel	608
955, cyanoguttatus B. & G	608
955 (b). pavonaceus Garm. (Addenda)	939
Family 96. Pomacentrida	609
325. Pomacentrus Lac	. 609
§ Pomacentrus	. 610
956. leucostictus Müller & Troschel	610
§ Hypsypops Gill	. 610
957. rubicundus Grd	. 610
325 (b). Glyphidodon Lac. (Addenda)	. 610, 939
958. declivifrons Gill. (Addenda)	. 611
959. saxatilis Linn	. 611
326. Chromis L	. 611
♦ Furcaria Poey. (Addenda)	. 939
960. punctipinnis Cooper	. 611
(Chromis	. 611
961. insolatus Cuv. & Val	. 612
961 (b). enchrysurus J. & G. (Addenda)	. 940
Family 97. Ephippida	. 61a
327. Chetodipterus Lac	. 61:
962, faber Brouss	
Family 98. Chetodontide	. 61.
328. Chetodon Linn	. 61-
963, maculocinctus Gill	. 613
963 (b), bimaculatus Bloch. (Addenda)	. 940
963 (c). capistratus L. 'Addenda')	. 940
329. Pomacanthus Lac	. 61
§ Holacanthus Lac	. 61
964. eiliaris Linu	. 61
964 (b). tricolor Bloch. (Addenda)	. 94
JOH (17), LITCOINT ALLOCAL (CENTRAL CONTROL CO	

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 98. Chactodontidae.	
§ Pomacanthus	615
965. arcnatus L	616
Family 99. Acanthuridæ	616
330. Acanthurus Bl. & Schn	617
966. chirurgus Bl. & Schn	617
965 (b). uigricans L. (Addenda)	941
° 966 (c). tractus Poey. (Addenda)	941
967. cæruleus Bl. & Schn	617
Family 100. Trachypteride	617
331. Trachypterus Gouan	615
968. altivelis Kner	618
Family 101. Icosteidæ	619
332. Icosteus Lock	620
969. ænigmaticus Lock	620
333. Icichthys J. & G	621
970. lockingtoni J. & G	621
334. Bathymaster Cope	622
971. signatus Cope	623
Family 102. Latilidae	623
335. Lopholatilus G. & B	624
972. chamæleonticeps G. & B.	624
336. Caulolatilus Gill	625
973. princeps Jen	625
974. chrysops C. & V	626
Family 102 (b). Trichodontide	626
337. Trichodon Steller	627
975. stelleri C. & V	627
Family 103. Uranoscopidæ	627
338. Astroscopus Brevoort	628
976. y-græcum C. & V	628
977. anoplus C. & V	629
Family 103 (b). Opisthognathidæ. (Addenda)	942
338 (b). Gnathypops Gill. (Addend 1)	942
977 (b). maxillosus Poey. (Addenda)	943
338 (c). Opisthognathus C. & V. (Addenda)	943
977 (c). scaphiurus Goode & Bean. (Addenda)	943
977 (d). lonchurus J. & G. (Addenda)	943
Family 104. Gobiidae	629
339. Gobiomorus Lac. (Addenda)	
978. dormitator Lac.	631
340. Electris Gronow.	631
979. gyrinus Cuv. & Val	631
341. Dormitator Gill.	
980 (981). maculatus Bloch. (Addenda)	631
341 (b). Culius Blecker. (Addenda).	632
981 (b). amblyopsis Cope. (Addenda)	944
349 9 Everthedus Cill (Addende)	944
342.? Evorthodus Gill. (Addenda) 987. würdemauni Grd. (Addenda)	632
(343) 344. Gobius L	632
§ Euctenogobius Gill	633
983. lyricus Grd.	633
983 (h) enegomus I & C (Addonda)	033

652

Ciass IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 104. Gobiida.	Con
§ Gobius	633
984 (982, 985), soporator C. & V. (Addenda)	
§ Coryphopterus (iii]	635
987 (b), bolcosoma J. & G. (Addeuda)	940
987 (c), stigmaturus Goode & Bean. (Addenda)	946
987 (d). nicholsi Bean. (Addenda)	940
988. glaucoframm Gill.	637
345. Gobionellus Grd	637
989. oceanicus Pall	630
989 (b), stigmaticus Poey. (Addenda)	947
346. Gillichthys Cooper	630
990. mirabilis Cooper	630
347. Lepidogobins Gill	6:27
§ Lepidogobius	637
991. gracilis Grd	637
§ Eucyclogobius Gill	637
992. newberryi Grd	637
992 (b) (986), gnlosus Grd. (Addenda)	
992 (c), thalassinus J. & G. (Addenda)	947
348. Gobiosoma Grd	638
993 (994), bosci Lac. (Addenda)	
994 (b). ios J. & G. (Addenda)	945
349. Typhlogobius Steind	639
995. californiensis Steind	639
350. Tyntlastes Gthr	639
996. sagitta Gthr	639
350 (b). Ioglossus Bean. (Addenda)	945
996 (b), calliurus Bean. (Addenda)	949
Family 105. Chiridae	646
351 (a). Pleurogrammus Gill. (Addenda)	642, 940
997. monopterygins Pall	643
351 (b). Hexagrammus Steller	641
998. ordinatus Cope	64:
999. asper Steller	64:
999 (b). scaber Bean. (Addenda)	949
1000. superciliosus Pall	644
1001. decagrammus Pall	64.7
352. Ophiodon Grd	646
1002. elongatus Grd	640
353. Zaniolepis Grd	647
1003, latipinnis Grd	647
354. Oxylebius Gill	648
1004, pietus Gill	648
355. Myriolepis Lock	649
1005, zoniter Lock	645
356, Anoplopoma Ayres	649
1006, fimbria Pallas	650
Family 106. Scorpænidæ	650
357. Sebastes Unvier	651
1007. marinus Linn.	651
358. Sebastodes Gill	65%

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 106. Scorpænidæ.	
§ Sebastodes	656
1008. paucispinis Ayres	656
≬ Sebastosomus Gill	657
1009, flavidus Ayres	657
1010, melanops Grd	658
1011. ciliatus Tiles	658
1012. mystinus Jor. & Gilb	659
1013. entomelas J. & G	659
1014. ovalis Ayres	660
1015. proriger J. & G	661
1016. atrovirens J. & G	662
1017. pinniger Gill	662
1018. miniatus J. & G	663
♦ Sebastomus Gill	664
1019. ruber Ayres	665
1019 (b). umbrosus J. & G. (Addenda)	950
1020, constellatus J. & G.	665
1021, rosaceus Grd	666
1022. rhodochloris J. & G	667
1023. chlorostictus J. & G	668
1024. elongatus Ayres	669
1025. rubrivinctus J. & G	669
§ Sebastichthys Gill	670
1026. aurienlatus Grd	670
1027. rastrelliger J. & G	671
1028. caurinus Rich	672
1028 (b). vexillaris J. & G	672
1029. maliger J. & G	673
1030. carnatus J. & G.	674
1031. chrysomelas J. & G	675
1032. nebulosus Ayres	676
1033. serriceps J. & G.	676
1034. nigrocinctus Ayres	677
359. Scorpæna L	678
1035. dactyloptera De La Roche	679
1036. guttata Grd	679
1037. plumieri Bloch	680
1038 (b). stearnsi Goode & Bean. (Addenda)	951
1038 (c). calcarata Goode & Bean. (Addenda)	952
360. Setarches Johnson	682
1039. parmatus Goode	682
Family 107. Cottide	682
361. Hemitripterus Cuvier	685
1040. americanus Gm	685
1041. cavifrons Lock	686
362. Ascelichthys J. & G	686
1042. rhodorus J. & G	686
363. Psychrolutes Günther	686
1043. paradoxns Gthr	687
364. Cottunculus Collett	687
1044. microps Collett.	688

•	
Class IV. Pisces—continued.	Page.
Subclass Physoelisti.	
Order T. Acanthopteri.	
Family 107. Cottidae.	
365. Ieelus Kröyer	689
§ Artedius Grd	689
1046. lateralis Grd	689
1047. notospilotus Grd	690
§ Icelus	690
1048. hamatus Kröyer	691
1049. quadriseriatus Lock	691
§ Chitonotus Lock	691
1050. megacephalus Lock	693
1051. pugettensis Steind	692
ý	
1052. uneinatus Reinh	693
1053, bicornis Reinh	693
366. Uranidea De Kay	693
§ Tauridea Jor. & Rice	694
1054. ricei Nelson. (Addenda)	694, 953
§ Cottopsis Grd	694
1055. aspera Rich	694
1056, semiscabra Cope	695
1056 (b). rhothea Rosa Smith. (Addenda)	953
§ Potamocottus Gill	695
1057. gulosa Grd	695
1058. punetulata Gill	696
1059. bendirei Bean	696
1060, richardsoni Agassiz	696
1061, wheeleri Cope	697
§ Uranidea	698
1062. eognata Rich	
1062 (b). spilota Cope. (Addenda)	954
1062 (c). pollicaris J. & G. (Addenda)	954
1062 (c). poincaris 5. & G. (Addenda)	698
1003, minuta Pan	698
1064, marginata Bean	698
1065, viscosa Hald	699
1066. gracilis Heek	699
1067. gobioides Grd	699
1068, boleoides Grd	
1069, franklini Ag	955
1069 (b), formosa Grd. (Addenda)	
1070. hoyi Putn	
367. Cottus L	
1071. bubalis L	
1072, octodecimspinosus Mitch	701
1073, æneus Mitch.	
1074, scorpioides Fabr	. 702 ~~~
1075, scorpius L	
1076, polyacanthocephalus Pall	
1077. labradoricus Grd	
1078. tæniopterus Kner	
1079. quadricornis L	704
1080. humilis Beau	
1081. jaok C & V	705

Class IV. Pisces—continued.	Paga
Subclass Physoclisti.	Page.
Order T. Acanthopteri.	
Family 107. Cottidæ.	
1082. axillaris Gill	706
1083. polaris Sab	706
1084, platycephalus Pall	706
1085, verrucosus Bean	707
1086, niger Bean	707
1087. quadrifilis Gill.	707
368. Gymnacanthus Sw.	708
1088, pistilliger Pall.	708
1089. galeatus Bean	709
369. Triglopsis Grd.	709
1090. thompsoni Grd	709
	710
370. Enophrys Sw.	710
1091, bison Grd	711
1092. dieeraus Pall	711
1093, claviger C. & V	711
371. Liocottus Grd	711
1094, hirundo Grd	712
872. Triglops Reinh	
1095. pingeli Reinh	713
373. Leptocottus Grd	713
1096. armatus Grd	713
374. Hemilepidotus Cuv	714
1097. spinosus Ayr	714
1098. jordani Bean	715
1099. trachurus Pall	715
375. Melletes Bean	716
1100. papilio Bean	716 716
376. Scorpenichthys Grd	716
1101. marmoratus Ayr	716
377. Oligocottus Grd	717
§ Clinocottus Gill	717
1102. analis Grd	717
§ Oligocottus	718
1103. maculosus Grd	718
§ Blennicottus Gill	718
1104. globiceps Grd	718
378. Blepsias Cuv	719
1105. cirrhosus Pall	719
1106. bilobus C. & V	720
379. Nautichthys Grd	<b>72</b> 0
1107. oculofasciatus Grd	721
380. Rhamphoeottus Gthr	721
1108. riehardsoni Gthr	722
Family 108 (a). Agonidæ	722
381. Aspidophoroides Lac	724
1109. monopterygius Bloch	724
1110. inermis Gthr	<b>7</b> 25
382. Siphagonus Steind	725
1111. barbatus Steind	725
383. Leptagonus Gill. (Addenda)	726,955

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 108 (a). Agonidæ.	
§ Brachyopsis Gill	726
1112. rostratus Tiles	726
1113. verrucosus Lock	726
1114. xyosternus J. & G	727
§ Leptagonus (Addenda)	955
1115. decagonus B. & S	727,955
[384. Agonus B. & S]	728
[1116. cataphractus L]	728
385. Bothragonus Gill	728
1117. swani Steind	729
386. Odontopyxis Lock	729
1118. trispinosus Lock	729
387. Podothecus Gill	729
1119. vulsus J. & G	730
1120. acipenserinus Tiles	730
Family 108 (b). Triglida	731
388. Peristedium Lac	732
1121. miniatum Goode	732
[389, Trigla L.]	733
[1122, cucnlus L.]	733
390. Prionotus Lac	733
§ Ornichthys Sw	734
1123. scitulus J. & G. (Addenda)	
1123. Schillis J. & G. (Addenda)	956
1123 (b). punctatus Bl. (Addenda)	734
1124. palmipes Mitch	735
§ Prionotus	
1125. tribulus C. & V	
1126. evolans L	
1127. stephanophrys Lock	736
391. Cephalacanthus Lac	737
1128. volitans L. (Addenda)	738,957
Family 109. Liparidide	738
392. Amitra Goode	
1129. liparina Goode	739
393. Careproctus Kröy	
1130. gelatinosus Pall	740
1130 (b). reinhardi Kröy. (Addenda)	957
394. Liparis L	740
§ Actinochir Gill	. 741
1131. major Walb	741
§ Liparis	740
1132. pulchella Ayr	. 741
1133. gibba Bean	
1135. tunicata Reinh	
1136 (1134). lineata Lepechin	
1137, ranula G. & B	742
1138. montagni Don	. 743
1139. calliodon Pall	. 743
1140. cyclopus Gthr	74:
§ Neoliparis Steind	. 744
11.11 mneosa Avr	

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	744
Family 110. Cyclopteride	744
395. Cyclopterichthys Steind	745 745
1142. ventricosus Pall	745 745
1143. stelleri Pall	
395 (b). Emmicrotremus Gill. (Addenda)	
1144. spinosus Müll	746
396, Cyclopterus L	746
1145. lumpus L	747
Family 111. Gobiesocidæ	747
397. Gobiesox Lac	748
1146, reticulatus Grd	749
1147. strumosus Cope	749
1147 (b). virgatulus J. & G. (Addenda)	957
1148, rhessodon R. Smith	749
Family 112. Batrachida	750
398. Batrachus B. & S	750
1149. tan L	750
1149 (b), pardus G. & B	751
399. Porichthys Grd	751
1150. margaritatus Rich. (Addenda)	
1150 (b). plectrodon J, & G. (Addenda)	958
Family 113. Leptoscopidae	752
400. Daetyloscopus Gill	753
1151. tridigitatus Gill	753
Family 114. Bleuniidæ	753
401. Ophioblennius Gill	756
1152. webbi Val	756
402, Chasmodes C. & V	756
1153. bosquianus Lae	756
1154. quadrifasciatus Wood	757
1154 (b). saburræ J. & G. (Addenda)	958
403, Isesthes J. & G	757
1155. gilberti Jor. (Addenda)	757, 959
1155 (b). gentilis Grd. (Addenda)	959
1156. punctatus Wood	758
1156 (b), heutzi Le S. (Addenda)	960
1156 (c), ionthas J. & G. (Addenda)	960
1156 (d). scrutator J. & G. (Addenda)	960
404. Hypleurochilus Gill	758
1157. multifilis Grd	758
1158. geminatus Wood	759
405. Bleunius L	750
& Blennius	759
[1159. fucorum C. & V.]	759
1159 (b). stearnsi J. & G. (Addenda)	961
1159 (c). favosus Goode & Bean. (Addenda)	961
1159 (d), asterias Goode & Bean. (Addenda)	961
\$\langle Pholis (\text{uv} \ldots) \tag{2}	760
1160. carolinus C. & V.	760
406. Neoclinus Grd	760
1161. satirieus Grd	761
1162. blanchardı Grd.	761
40° Clinas Cuy	761

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order T. Acanthopteri.	
Family 114. Blenniidæ.	
§ Lubrosomus Sw	762
1163. nuchipinuis Q. & G	762
§ Gibbonsia Coop	763
1164. evides J. & G	763
408. Heterostichus Grd.	762
1165. rostratus Grd	764
	764
409. Cremnobates Gthr	764
1166. integripinnis R. Smith	
1166 (b). marmoratus Steind. (Addenda)	962
410. Chirolophus Sw	765
1167. polyactocephalus Pall	765
411. Murænoides Lac	766
§ Muranoides	767
1168. gunnellus L	767
1169. fasciatus B. & S	767
1170. ornatus Grd	767
1171. maxillaris Bean	768
1172. dolichogaster Pall	768
§ Asternopteryx Rüpp	769
1173. guuelliformis Rüpp	769
412. Apodichthys Grd	769
1174. flavidus Grd	769
1175. fucorum J. & G	770
413. Anoplarchus Gill	770
1176. atropurpureus Kittl.	771
1177. alectrolophus Pall	771
The state of the s	771
414. Xiphister Jor.	772
1178. chirns J. & G	772
1179. mucosus Grd	
1180. rupestris J. & G.	773
415. Cebedichthys Ayres	773
1181. violaceus Grd	774
416. Emmesogrammus Gill	774
1182. pracisus Kröy	774
1183. subbifurcatus Stor	775
417. Stichaeus Reinh	775
1184. punctatus Fabr	775
418. Notogrammus Bean	776
1185. rothrocki Bean	776
419. Lumpenus Reinh	776
§ Leptoclinus Gill	777
1186. maculatus Fries	777
♦ Anisarchus Gill	777
1187. medius Reinh	777
§ Lumpenus	777
1188. auguillaris Pall	777
1189. fabricii C. & V.	778
420. Leptoblemins Gill	778
1190. nubilus Rich	778
1191. serpentinus Stor	778
1192. lampetræformis Walb.	779
	110
Bull. Nat. Mus. No. 16——IV	

Class IV. Pisce Subclass Phy	soclisti.	Page.
	canthopteri.	
Family	114. Blenniidæ.	
421	、Delolepis Bean	779
	1193. virgatus Bean	779
422	2. Cryptacanthodes Stor	780
	1194. maculatus Stor	780
423	3. Anarrhichas L	781
	1195. lupus L	781
	1196. minor Olafs	7.01
	1197. latifrons Steenstrup & Halgrimsson	782
	1198. lepturus Bean	782
49.1	. Anarrhichthys Ayres	782
404	1199. ocellatus Ayr	782
Vamily	*	783
	115. Lycodidæ	
420	. Zoarces Cuv	784
	1200. auguillaris Peck	784
420	5. Lycodopsis Coll	784
	1201. pacificus Coll	<b>7</b> 85
	1202. paucidens Lock	<b>7</b> 85
427	. Lycodes Reinh	785
	1203. paxillus G. & B	<b>7</b> 85
	1204. verrilli G. & B	<b>7</b> 86
	1205. vahli Reinh	786
	1206. esmarki Coll	<b>7</b> 86
	1207. reticulatus Reinh	787
	1208, seminudus Reinh	787
	1209. nebulosus Kröy	787
	1210. coccineus Bean	787
428	. Lycodalepis Bleeker	788
	1211. mucosus Rich	788
	1212. turneri Bean	788
	1213. polaris Sab	788
429	. Gymnelis Reinh	789
	1214. viridis Fabr	789
	1215. stigma Benn	789
130	Uronectes Gthr	789
400.	1216. parrii Ross	789
Family	· · · · · · · · · · · · · · · · · · ·	790
	116 Congrogadida	790 790
4.01	Seytalina J. & G	790 790
12	1217. cerdale J. & G	
	117. Fierasferidæ	791
432	. Pierasfer Cuv	791
**	1218. dubius Putn	791
	118. Ophidiida	792
433.	Ophidium L	792
	♦ Ophidium	792
	1219. marginatum Dek	792
	1220. josephi Grd	793
	1221. holbrooki Putn	793
	1221 (b). graëllsi Poey. (Addenda)	963
	1222. taylori Grd	<b>7</b> 93
	§ Leptophidium Gill	<b>7</b> 93
	1223. profundorum Gill	<b>7</b> 93
433	(b). Genypterus Philippi. (Addenda)	963
	1223 (b). omostigma J. & G. (Addenda)	963

Class IV. Pisces—continued. Subclass Physoclisti.	Page.
Order T. Acanthopteri.	
Family 120 (119), Gadidæ	794
434. Bythites Reinh	795
1224. fuscus Reinh	795
435. Dinematichthys Bleck	795
§ Brosmophycis Gill. (Addenda)	796, 963
1225. marginatus Ayres	796
436. Onos Risso	796
♦ Rhinonemus Gill.	797
1226. cimbrius L	797
§ Onos	797
1227. reinhardti Kröy	797
1228. eusis Reinh.	797
437. Phycis B, & S	798
1229, regius Walb	798
	798
1230. earlli Bean	799 799
1231. chuss Walb	
1232. tenuis Mitch	799
1233, chesteri G. & B	799
438. Haloporphyrus Gthr	800
1233 (b). viola G. & B	800
439. Physiculus Kaup	800
1234. dalwigkii Kaup	801
440. Molva Nilss	801
1235. vulgaris Flem	801
441. Lota Cuv	801
1236, maculosa Le S	802
442. Brosmius Cuv	802
1237. brosme Müll	802
443. Gadus L	803
§ Melanogrammus Gill	803
1238. æglifinus L	803
§ Gadus	804
1239. callarias L	804
≬ Tilesia Sw	804
1240. gracilis Tiles	S04
§ Microgadus Gill	805
1241. proximus Grd	805
1242, tomcod Walb	806
§ Pollachius Nilss	806
1943, virens L	806
1244. chalcogrammus Pall	807
§ Borvogadus Gthr	807
1245. saida Lepechin	807
444. Hypsicometes Goode	808
1246. gobioides Goode	803
445, Merlucius Raf	803
1247. bilinearis Mitch	809
1248. smiridus Raf	809
1249. productus Ayres	809
Family 120 (b). Chiasmodontidæ. (Addenda)	964
446. Chiasmodon Johns	810
1250. niger Johns	810
TOOM HISOT AAHTO IIIIII IIII IIII IIII IIIII IIIII IIIII	0.10

Class IV. Pisces—continued. Subclass Physoclisti.	Page.
Order T. Acanthopteri.	
Family 121. Macruvide	810
447. Macrurus Bloch	811
1251. fabricii Sundev	811
1252. carminatus Goode	812
1253. bairdi G. & B	812
448. Coryphæno des Gunner	812
1254. rupestris Gunner	812
Order U. Heterosomata	813
Family 122 (123). Pleuronectide	813
449. Bothus Raf	815
1255. maculatus Mitch	815
450. Citharichthys Bleek	816
§ Hemirhombus Bleek	816
1256. pætulus Goode & Bean. (Addenda)	816,964
1256 (b). ocellatus Poey. (Addenda)	817,964
§ Citharichthys	817
1257. sordidus Grd	817
1257 (b), stigmæns J. & G. (Addenda)	965
1258. spilopterus Gthr	817
1259. arctifrons Goode	818
1260. unicornis Goode	818
451. Hippoglossus Cuv	818
1261. vulgaris Flem	819
452. Platysomatichthys Bleek	819
1262. hippoglossoides Walb	819
453. Atheresthes J. & G	830
1263. stomias J. & G	820
454. Paralichthys Grd	821
§ Paralichthys	821
1264 californicus Ayr	821
1265. ocellaris Dek. (Addenda)	822, 972
1266. dentatus L	822
1267. albigutta J. & G	823
1268. squamilentus J. & G.	823
1269. oblongns Mit	824
1270. ommatus J. & G	824
§ Xystreurys J. & G	825
1271. liolepis J. & G	825
455. Hippoglossoides Gottsche	825
§ Hippoglossoides	826
1272. platessoides Fabr	826
1273. elassodon J. & G	826
1274. jordani Lock	827
1275. exilis J. & G	827
§ Psettichthys Grd	828
1276. melanostictus Grd	828
456. Pleuronichthys Grd	828
1277. decurrens J. & G	829
1278. verticalis J. & G	829
1279. cœnosus Grd	830
457. Hypsopsetta Gill	830
1280. guttulata Grd	830

## TABLE OF CONTENTS.

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order U. Heterosomata.	
Family 122 (123). Pleuronectidæ.	
458. Pleuronectes L	. 831
♦ Parophrys Grd	. 831
1281. vetulus Grd	. 831
≬ Isopsetta Lock	. 832
1282. isolepis Lock	
1283. ischyrus J. & G	
♦ Lepidopsetta Gill	
1284. bilineatus Ayr	
§ Limanda Gottsche	
1285. ferrugineus Stor	
1286. asper Pall	
1287. beani Goode.	
§ Platichthys Grd	
1288. stellatus Pall	
§ Pleurouectes	. 000
1289. quadrituberculatus Pall	
1290. glaber Stor	
1291. glacialis Pall	
§ Fseudopleuronectes Bleek	
1292. americanus Walb	
459. Glyptocephalus Gottsche	
1293. cynoglossus L	
1294. zachirus Lock	
460. Cynicoglossus Bonap	
1295. pacificus Lock	- 839
461. Etropus J. & G	
1296. crossotus J. & G	
462. Thyris Goode	. 840
1297. pellucidus Goode	. 840
463. Monolene Goode	
1298. sessilicanda Goode	. 841
463 (b). Baostoma Bean. (Addenda)	965
1298 (b). brachiale Bean. (Addenda)	
464. Achirus Lac	
1299. lineatus L	
465. Aphoristia Kaup	
1300. atricanda J. & G	
1301. plagiusa L	
Order V. Pediculati	
Family 124. Lophiidæ	
466. Lophius L	
1302. piscatorius L	
Family 125 (a). Autennariidæ	
466 (b). Pterophrynoides Gill	. \$45
1303. histrio L	. 645 . 845
467. Antennarius Lac.	. €45 - 845
1304. annulatus Gill	. (33) . 846
1305. pleurophthalmus Gill	. 540 . 846
468. Chamax Lowe	. 546 . 846
1306. pictus Lowe :-	. 540 . 847
Family 125 (b.) Ceratiidae	
469. "Ceratias Kröver	847
iou, coluitas iliujul	U4.1

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order V. Pediculati.	
Family 125 (b). Ceratiidæ.	
1307. holbölli Kröy	847
470. Mancalias Gill	848
1308. uranoscopus Murray	848
471. Ouirodes Liitk	848
1309. eschrichti Liitk	848
472. Himantolophus Reinh	849
1310. grownlandicus Reinh	849
1311. reinhardti Liitk	849
Family 126. Malthida	849
473. Malthe Cuv	850
1312. vespertilio L	850
1313. cubifrons Rich	850
474. Halieutichthys Poey	851
1314. aculeatus Mitch	851
475. Halientiea C. & V.	851
1315. senticosa Goode	851
Order W. Plectognathi	852
Family 127. Ostraciidæ	852
476. Ostracium L	853
≬ Lactophrys Sw	853
1316. trigonum L	853
1316 (b). triquetrum L. (Addenda)	965
1317. quadricorne L	854
Family 128. Balistide	854
477. Balistes L	854
1318. vetula L	855
1319. capriscus Gmel	855
1320. poweli Cope	855
478. Monacanthus Cnv	856
§ Monacauthus	856
1321. oceidentalis Gthr	856
§ Stephanolepis Gill	856
1322. hispidus L. (Addenda)	
1323. davidsoni Cope	857
1324. spilonotus Cope	857
§ Cantherines Sw	858
1325. pullus Ranz	858
479. Alutera Cuv	858
1326. schæpffi Walb	858
1327. scripta Osb	859
Family 129. Tetrodontida	859
480. Lagocephalns Sw	859
1328. lævigatus L	860
481. Tetrodon L	860
1320. politus Grd	860
1330. testudineus L	861
1331. speugleri Bl	861
1332. turgidus Mitch	861
1332 (b). nephelus Goode & Bean. (Addenda)	966
1333. trichocephalus Cope	862
482. Trichodiodon Bleek	863
1334. pilosus Mitch	862

## TABLE OF CONTENTS.

Class IV. Pisces—continued.	Page.
Subclass Physoclisti.	
Order W. Plectognathi.	
Family 129. Tetrodontidæ.	
483. Diodon L	862
1335, hystrix L	863
1336. liturosus Shaw. (Addenda)	863, 966
484. Chilomycterus Bibron	863
1337. geometrieus B. & S.	563
1337 (b). fuliginosus Dek	864
1337 (c). reticulatus L. (Addenda)	966
Family 130. Orthagoriscide	864
485. Molacanthus Sw	865
1338. nummularis Walb	865
486. Mola Cuv	865
1339. rotunda Cuv	865
487. Ranzania Nardo. (Addenda)	966
1940 Americanto Duta (Addende)	0.00

## LIST OF NEW GENERA AND SPECIES.

The following specific and generic names appear as new in the present work. A number of other descriptions of new species in the Addenda are abridged from manuscripts and proof-sheets of the current volume of the Proceedings of the United States National Museum. It is probable that in all cases the date of their publication in these proceedings will be previous to the issue of the present volume.

Minnilus scepticus J. & G	
Platygobio pallidus Forbes	
Trycherodon Forbes	
Trycherodon megalops Forbes	
Coregonus kennicotti Milner	
Fundulus adinia J. & G.	
Euthynnus Lütken	
Lepomis symmetricus Forbes	
Cottogaster putnami J. & G	
Pæcilichthys butlerianus Hay	
Bothragonus Gill	
Cottunculus torvus Goode	
Isesthes J. & G	
Clinus evides J. & G.	
Paralichthys ophryas J. & G	- <b></b> .
Paralichthys omniatus J. & G	
Isopsetta Lockington	
Petromyzon marinus dorsatus Wilder	
Galeorhinus zyopterus J. & G	
Fundulus zebrinus J. & G	
Menidia laciniata Swain.	
Menidia audens Hay	
Xenistins J. & G	

## A SYNOPSIS OF THE FISHES OF NORTH AMERICA.

Ichthyology ( $i\chi\theta\delta\tau$ , fish;  $\lambda\delta\gamma\sigma\tau$ , a discourse) is the science of fishes. A "fish," in the popular sense, is a member of any one of the four classes of aquatic or fish-like vertebrates, the groups here designated as *Pisces*, *Elasmobranchii*, *Marsipobranchii*, and *Leptocardii*. A fish, in this comprehensive and somewhat indefinite sense, may be defined as a cold-blooded vertebrate, adapted for life in the water; breathing by means of gills; having the limbs, if present, developed as fins; the fingers and toes being represented by cartilaginous rays connected by membrane; the exoskeleton obsolete or developed as scales or bony plates; and one or more fins developed on the median line of the body, usually composed of rays connected by membrane.

Of a "fish" in the popular sense one could hardly say more, without the necessity of the constant introduction of exceptions. Of a "true fish," a fish in a strict zoölogical sense,—that is, a member of the class *Pisces*,—a definition will be given further on.

Among the fish-like vertebrates, the writers, following Professor Gill and other eminent authorities, recognize four classes, considered as co-ordinate with the classes *Batrachia*, *Reptilia*, *Ares*, and *Mammalia*. These four classes have been thus limited and characterized:

#### ANALYSIS OF THE CLASSES OF FISH-LIKE VERTERRATES.

- \* Skull undeveloped, with the notochord persistent and extending to the anterior end of the head. Brain not distinctly differentiated. Heart none.
  - LEPTOCARDII, 1.
- \*\* Skull more or less developed, with the notochord not continued forward beyond the pitnitary body. Brain differentiated and distinctly developed. Heart developed and divided at least into an auriele and a ventricle.
  - †Skull imperfectly developed, and with no lower jaw. Paired fins undeveloped, with no shoulder-girdle nor pelvic elements. Gills purse-shaped,

    Marsipobranchi, 2.
  - tt Skull well developed and with a lower jaw. Paired fins developed (sometimes absent through atrophy); and with a shoulder-girdle (lyriform or furculashaped, curved forward and with its respective sides connected below), and with pelvic elements. Gills not purse-shaped. (LYRIFERA.)

‡Skull without membrane bones (a "rudimental opercular bone" in Chimara); gills not free, the branchial openings sli(-like, usually several in number; exoskeleton placoid, sometimes obsolete; eggs few and large.

Elasmobranchii, 3,

# CLASS I.—LEPTOCARDII.

(The Lancelets.)

Skeleton membrano-cartilaginous; skull undeveloped, with the notochord persistent and extending to the anterior end of the head. Brain not differentiated. No heart; the function of the heart being performed by pulsating sinuses. Blood colorless. Respiratory cavity confluent with the cavity of the abdomen; branchial clefts in great number, the water being expelled through an abdominal pore in front of the vent. Jaws none; the mouth a longitudinal fissure, with cirri on each side.

Small marine animals highly interesting to the zoölogist as exhibiting the lowest degree of development of the vertebrate type. The class includes but the single order Cirrostomi. ( $\lambda \epsilon \pi \tau \delta \epsilon$ , thin;  $za\rho \delta ia$ , heart.) (Subclass Leptocardii Günther, viii, 513–514.)

## ORDER A.—CIRROSTOMI.

(The Cirrostomes.)

This order is equivalent to the family *Branchiostomatidæ*. (Latin, *cirrus*, a lock of hair; στόμα, month: the mouth being surrounded by a fringe of cirri.) (*Cirrostomi* Günther, viii, 513–514.)

## FAMILY I.—BRANCHIOSTOMATIDÆ.

(The Laneclets.)

Body elongate, compressed, naked, colorless, with no fins, except a rayless fold extending along the back, around the tail, past the vent, to the abdominal pore. Mouth inferior, appearing as a longitudinal fissure, surrounded by conspicuous, rather stiff cirri. Eye rudimentary. Liver reduced to a blind sac of the simple intestine.

Genera two, Branchiostoma and Epigonopterus, differing chiefly in

the greater development of the dorsal fin in the latter. Species four or more, found imbedded in the sand on various coasts. (*Cirrostomi* Gthr. viii, 513-514.)

\* Dorsal fold very low, nearly uniform .......BRANCHIOSTOMA, 1.

### 1.—BRANCHIOSTOMA Costa, 1834.

### Lancelets.

(Amphioxus Yarrell.)

(Costa, Cenni Zoologici Napol. 1834, p. 49: type Branchiostoma lubricum Costa = Limax lanceolatus Pallas.)

The characters of this genus are essentially those of the family as given above, the little development of the fins constituting its chief distinctive character. (βμάγχια, gills; στόμα, mouth.)

#### 1. 13. Carribarren Sundevall.—American Lancelet.

This species occurs in abundance, buried in the sand in shallow waters, along the American coast, from the mouth of Chesapeake Bay to the West Indies. It has never been fully compared with *B. lanceolatum* and other species of the genus.

(Branchiostoma caribaum Sundevall, Oefvers. Vet. Akad. Förhandl. 1853, 11.)

# CLASS II.—MARSIPOBRANCHII.

(The Myzonts.)

Skeleton cartilaginous; the skull imperfectly developed, not separate from the vertebral column. No ribs, no true jaws, no limbs, no shoulder-girdle, nor pelvic elements. Gills in the form of fixed saes, without branchial arches, six or more in number on each side. A single nasal aperture. Month subinferior, snetorial, nearly circular. Heart without arterial bulb. Alimentary canal straight, simple, without excell appendages, pancreas, or spleen. Generative outlet peritoneal. Vertical fins with feeble rays, continuous around the tail. Naked, eel-shaped animals, inhabiting all waters. ( $\mu a \rho \sigma i \pi t \sigma v$ , a small pouch or purse;  $\beta \rho i \gamma \chi z a$ , gills.) (Subclass Cyclostomata Günther, viii, 499–512.)

#### ORDERS OF MARSIPOBRANCHIL

- \* Nasal duct tube-like, with cartilaginous rings, penetrating the palate.
  - Hyperotreta, B.

## ORDER B.—HYPEROTRETA.

(The Myxinoid Fishes.)

Nostril tube-like, with cartilaginous rings, penetrating the palate, its position at the extremity of the head, over the mouth; snont with eight barbels; mouth without lips; one median tooth on the palate and two comb-like series of teeth on the tongue. Branchial apertures at a great distance from the head; a series of mucous sacs along each side of the abdomen. Intestine without spiral valve. Eggs large, with a horny case provided with threads for adhesion. Marine lamprey-like animals, burrowing into the flesh of fishes, on which they feed.

There is but one family,  $Myxinid\alpha$ , unless we assign separate rank to Bdellostoma on account of the difference in the gill-openings. ( $\delta\pi\epsilon\rho\dot{\omega}a$ , palate;  $\tau\rho\eta\tau\delta\tau$ , perforate.) (Family  $Myxinid\alpha$  Günther, 510–512.)

## FAMILY II.—MYXINIDÆ.

(The Hag-fishes.)

The characters of the family are included above. Genera two; species few; marine animals, found in all temperate seas. (Myxinidæ Günther, viii, 510-512.

\* Branchial apertures one on each side, leading by six ducts to six branchial sacs.

MYXINE, 2.

#### 2.-MYXINE Linnans, 1758.

## Hag-fishes.

(Linnæus, Systema Naturæ: type Myxine glutinosa L.)

Body eel-shaped, covered by a thin skin, which is easily detached. Along the lower side, for nearly the whole length of the animal, are two rows of mucous glands, each with an external opening, from which exudes a quantity of mucus which renders these animals during life excessively slimy. No eyes. Brain small, of the normal fish type. Skull little developed, cartilaginous; the flexible notochord enclosed in its sheath, and extending from the base of the skull to the end of the

tail representing the spinal column. Mouth round, suctorial, without lins, with a pair of barbels on each side. Nostril single, large, on the median line above, and at the very front of the head, provided with two pairs of barbels. Teeth strong, a single median one on the roof of the mouth, and two rows on each side of the tongue, which is a powerful organ, with a strong fibrous tendon moving in a muscular sheath. Alimentary canal a simple, nearly straight tube. Gill-sacs placed on each side of the assophagus, lying directly against its outer The water passes into them by a small pore opening directly from the esophagus into each sac. It is then passed out by a duct. which continues backward along the outer walls of the sacs to the abdominal wall at the end of the last sac, where all the ducts from one side unite in one, and the water is emptied at the branchial opening on each side of the median line. In close connection with the branchial opening on the left side there is a third opening that leads by a very short duct to the esophagus, and hence into the branchial sacs, at times when the supply through the mouth is cut off by the head being buried in the food of the animal. Ovary single, on the right side. No oviducts: the mature eggs falling into the abdominal cavity are excladed through the peritoneal opening at the side of the vent.—(Putnam.)

A single species; colorless, parasitic animals, burrowing into the bodies of fishes, and found in all temperate seas. ( $\mu b \xi \tilde{a}$ , slime.)

#### 2. M. glutinosa L.—Hag-fish; Borer; Sleepmarken.

Blue above, whitish below; head 3½ to 4 in total length; tail 6½ to 10 times in total length; lingual teeth 8 to 11 in each row (*Putuam*). Coasts of Europe and America; not abundant on our shores.

(L. Syst. Naturae; Günther, viii, 510; Putnam, Proc. Bost. Soc. Nat. Hist. 1873, 135; Myxino limosa Girard, Proc. Ac. Nat. Sci. Phila. 1858, 223.)

## 3.—BDELLOSTOMA Müller, 1834.

(Müller, Abhandl. Akad. Wiss. Wien, 1834, 79: type Petromyzon cirrhatus Forster.)

This genus differs from Myxine chiefly in the structure of the branchial apparatus, there being six or more sacs on each side which receive water directly from the esophagus as in Myxine, but the emptying ducts, instead of passing backward and downward to a common external opening, as in Myxine, pass directly through the wall of the body, so that there are as many external openings as there are gill-sacs. Warm seas. ( $\beta \delta \xi \lambda \lambda a \tau$ , leech;  $\sigma \tau \delta \mu a$ , mouth.)

#### 3. B. stouti\* Lockington.

"Eleven gill openings on each side; ten teeth in the anterior and nine in the posterior series. Fifteen inches long."—(Lockington.) Coast of California; not rare.

(Lockington, Amer. Nat. Dec. 1878, 793.)

## ORDER C.-HYPEROARTIA.

(The Lampreys.)

Nasal duct a blind sac, not penetrating the palate. This order is equivalent to the single family Petromyzontidæ. (ὁπερώα, palate; ἀρτιος, complete; i. e., entire.) (Petromyzontidæ Günther, 499–509.)

## FAMILY III.—PETROMYZONTIDÆ.

(The Lampreys.)

Body eel-shaped, naked, subcylindrical anteriorly, compressed behind; mouth nearly circular, suctorial, armed with horny teeth, which are simple or multicuspid, resting on papillæ; those immediately above and those immediately below the opening of the æsophagus more or less specialized; eyes present; branchial openings seven, arranged in a linear series along the sides of the "chest"; nostril on the top of the head; lips present, usually fringed; dorsal fin more or less deeply divided by a notch; the posterior part commonly continuous with the anal around the tail; intestines with a spiral valve; eggs small.

These animals undergo a metamorphosis; the young are usually toothless and have the eyes rudimentary. Such forms have, until lately, been considered as forming separate genera, which have been termed Ammocætes, Scolecosoma, Chilopterus, etc.

Genera 5 or 6; species 15 or 20; found in all waters in temperate regions. They attach themselves to fishes and feed by scraping off the flesh with their rasp-like teeth. Among our species, four groups, apparently of generic value, may be recognized, but the characters in

<sup>\*</sup> This species may be identical with *B. polytrema* Grd. from Chili, incorrectly described in Proc. Ac. Nat. Sci. Phila. 1854, 199, and thus characterized by Putnam, Proc. Bost. Soc. Nat. Hist. 1873, 160:

<sup>&</sup>quot;Head about one third of total length, and contained about 1½ times in the length of the abdomen. Tail contained 7 to 8 times in total length. Base of tongue between the seventh or eighth pair of gills. Gills ten on each side. Length from 13 to 22 inches. Habitat: Coast of Chili,"

several instances need verification, especially in regard to the lingual dentition. (*Petromyzontidæ* Giinther, viii, 499–509.)

- \* Second dorsal continuous with the caudal.
  - a. Maxillary tooth single, forming a crescent-shaped plate, with a distinct cusp at each end, between which is sometimes a median cusp.
  - aa. Maxillary tooth double or triple, composed of two or three pointed cusps, close together, not forming a crescent-shaped plate (lingual teeth in two pairs, the posterior pair at least pectinate).

## 4.-LAMPETRA Gray, 1851.

## Lamperns.

(Gray, Chondropterygians, 140: type Petromyzon fluviatilis L.)

Lampreys of rather small size, with the maxillary tooth single, developed as a broad crescent-shaped plate, with a cusp at each end of it, the two separated by a broad interspace, in the middle of which is sometimes a smaller cusp. Dorsal fin divided by a deep notch, which breaks the continuity of the fin; second dersal connected with the caudal; mandibulary plate well developed, the number and arrangement of its teeth varying with the species; lingual teeth finely pectinate; lips usually conspicuously fringed. The species are little known. One of them, L. fluriatilis, is European, and is closely related to L. plumbea; the other described species are American. (Latin, lampetra, a lamprey, from lambere, to suck; petra, stone.)

- \* Maxillary tooth tricuspid, a small median cusp being present; mandibulary cusps comparatively few and weak. (Entosphenus Gill.)
  - †Mandibulary plate with five cusps, the middle ones smaller.
    - ‡ Lips fringed with conspicuous papillæ.

## 4. L. tridentata (Gairdner) J. & G .- Three-toothed Lamprey.

Lips thick, fringed with numerous papilla, each papilla standing in the middle of a little circular depression having a raised margin, which is partly concealed by a rugose tessellated plate investing the inner surface of the lips, and of the same horny nature with that which forms the outside of the teeth; both are softened and peel off in spirits. Four small, acute, conical teeth stand in a row across the upper part of this plate, and four larger ones occupy each of its sides, the upper and lower pairs being bicuspid and the middle ones tricuspid; these stand on the sides of the maxillary ring or inner orifice, and have their ends turned toward it; the inferior margin of this orifice is armed with a slightly curved dental piece, having five acute points or teeth (the outer being larger than the three middle); opposite to it on the upper side of the orifice is another piece having two large, acutely conical teeth, with a smaller central one. The tongue is also clothed with a horny-looking substance, which is edged anteriorly by a row of about twenty fine teeth. The dorsal fins rise in even curves, which are highest in the middle; the first is about one third of its own length from the second. Back and sides bluish gray, with irregularly scattered yellowish patches; belly yellowish white. Size rather large.—(Richardson.) Pacific coast of North America, ascending streams.

(Petromyzon tridentatus Gairdner, MSS.; Richardson, F. B. A. 293; Petromyzon ciliatus Ayres, Proc. Cal. Ac. Sci. 1854, 44; Petromyzon ciliatus et lividus Grd. Pac. R. R. Surv. 378, 379; Ichthyomyzon tridentatus Gthr. viii, 503.)

# Lips without fringes of papilla.

## 5. L. epiliexodon (Gill) J. & G.—Six-toothed Lamprey.

This species is said to differ from *L. tridentata* in the absence of a fringe of papillae around the buccal disk, and in the presence of six instead of four teeth in the upper transverse row.—(*Girard.*). Sacramento River.

(Petromyzon tridentatus Grd. Pac. R. R. Surv. 377; not Rich.: Entosphenus epihexodon Gill, Proc. Ac. Nat. Sci. Phila. 1862, 33.)

tt Mandibulary plate with six cusps, which are nearly equal in size.

#### 6. L. astori (Grd.) J. & G.

Lips fringed; head 6½ in length; first dorsal lower than the second, separated from it by a space nearly equal to a third of its length; no anal fin; yellowish brown, darker above.—(Girard.) Astoria, Oregon.

(Petromyzon astori Girard, Pac. R. R. Surv. 380: Ichthyomyzon astori Günther, viii, 507.)

\*\* Maxillary plate bicuspid, the small median cusp wanting; mandibulary plate with about eight rather strong, subequal teeth. (Lampetra.)

#### 7. L. plumben (Ayres) Gill,—Lead-colored Lamprey.

Lips fringed; head 8½ in length; first dorsal much lower than the second, and separated from it by a space equal to half of its own length; tail tapering to a point; a single bicuspid tooth on each side of the orifice of the mouth. Pacific coast; a small species, scarcely distinguishable from the European L. fluviatilis.

(Petromyzon plumbeus Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 28: Petromyzon ayresi Günther, yiii, 505; Ammocates ciburius Girard, Pac. R. R. Surv. 383.)

#### 5.-AMMOCCETES Duméril, 1817.

### Brook Lampreys.

(Duméril—Cuvier, Règne Animal : type Petromyzon bra..ehialis L. = the larval form of Petromyzon planeri Bloch.)

Lampreys of small size, with the dorsal fin continuous, sometimes emarginate, but never divided into two tins, the posterior portion continuous with the low anal fin around the tail; maxillary tooth single, broad, forming a crescentic plate, with a large bluntish cusp at each end, and sometimes a small median cusp; lateral teeth very few; tongue with two broad transverse plates, each with a median cusp; species few; our single species is scarcely distinguishable from the common "Pride" or "Small Lamprey" of Europe, Ammocœtes branchialis. (ἀρμος, saud; χοίτη, to lie.)

### 8. A. miger (Raf.) Jor.—Small Black Lamprey.

Head moderate, nearly as long as the "chest"; the mouth comparatively small; lips with a conspicuous fringe of papillae; dorsal fin high, considerably depressed in front of the vent, but not divided into two fins; the posterior lobe highest; anal fin evident; anal tube conspicuous in the spring; eyes moderate; maxillary tooth with its cusps large, triangular, well separated; a small pointed median cusp usually present in the adult; in younger specimens the median cusp is obsolete, and in half-grown specimens the tooth forms a curved plate without distinct cusps; mandibular plate curved, with *eight* to *ten* well developed subequal tooth-like lobes; inside of it is a plate bearing three teeth; lingual teeth transverse, trifid; a plate on each side of the buccal orifice; the remaining teeth inconspicuous. Bluish black above; silvery below. Size rather small. L. 6 to 10.

A small species ascending Western streams in the spring in great numbers to deposit its spawn. Great Lakes, Ohio Valley, and Upper Mississippi Region. It is perhaps identical with the European Ammocates branchialis.

(Petromyzon nigrum Raf. Ich. Oh. 81; Jordan, 349.)

### 6.—ICHTHYONYZON Girard, 1859.

Silvery Lampreys.

(Girard, Pac. R. R. Surv. x, 381: type Petromyzon argenteus Kirtland.)

Lampreys of rather small size, having the dorsal fin high and continuous, with only a shallow emargination; the teeth nearly equal over

the large buceal disk, the maxillary teeth being pointed, two in number, set close together, without interspace, and not forming a crescent-shaped plate; lateral teeth all unicuspid; mandibulary with numerous closeset pointed cusps, appearing like distinct teeth; lingual teeth in two series, the posterior series finely pectinate, with a median suture dividing it into a right and left crescent-shaped comb; anterior series not divided; the pectinac coalescent. This genus is most nearly related to Petromyzon, differing chiefly in the continuous dorsal. The two known species inhabit the Mississippi Valley and the Great Lakes. ( $i\chi\theta\delta z$ , fish;  $\mu\delta \zeta\omega$ , to suck.)

\* Mandibulary plate with seven teeth.

## 9. I. argenteus (Kirt.) Grd.—Silvery Lamprey.

Body stoutish, compressed behind; head broad, with large buccal disk, which is fringed, but not very conspicuously; teeth pretty strong and nearly uniform, the two maxillary teeth being very similar to those on the rest of the disk; mandibulary teeth connivent, the middle ones the longest; upper margin of dorsal scarcely depressed in front of the vent. Color bluish; sides silvery, often mottled; a small dusky spot above or nearly above each gill-opening, usually conspicuous. L. 12. Great Lakes and Mississippi Valley; rather common; ascending small brooks in the spring.

(Petromyzon argenteus Kirtland, Bost. Journ. Nat. Hist. iii, 1840, 342, with plate.— Ammocates concolor Kirt. l. e. 473, with plate.—Iehthyomyzon hirudo Grd. Pac. R. R. Surv. 342.—Iehthyomyzon hirudo Gthr. viii, 507.—Ammocates argenteus et hirudo Jordan, 349-'50.—Ammocates apyptera Abbott, Proc. Ac. Nat. Sci. Phila. 1860, 327.)

\*\* Mandibulary plate with nine teeth.

### 10. I. castaneus Grd.—Chestnut-colored Lamprey.

Lips with short fringes; dorsal fin high, with a depression in front of the vent. A little known species, differing from the preceding, if at all, in the number of teeth on the mandibulary plate. Minnesota.

(Ichthyomyzon castaneus Grd. Pac. R. R. Surv. 381.)

#### 7.—PETROMYZON Linnæus, 1758.

## Sca Lampreys.

(Artedi Linn:ens, Systema Naturæ; type Petromyzon marinus L.)

Lampreys of medium or large size, with the maxillary teeth separate, pointed, and close together, not forming a crescent-shaped plate; mandibulary plate with seven to nine cusps; lingual teeth forming two crescent-shaped plates on each side; first dorsal fin well separated from

the second, which is continuous with the caudal. Species two—marine, ascending rivers. ( $\pi \xi \tau \rho a$ , stone;  $\mu \delta \xi \omega$ , to suck.)

### 11. P. marinus L.—Great Sea Lamprey.

Head moderate, but little longer than the "chest"; buccal disk large, with numerous conical teeth, arranged in oblique series, those nearest the æsophagus largest and partly bicuspid; two pairs of lunate, pectinate lingual teeth, one in front of the other, the serrations on the anterior pair usually confluent; fins moderate, the dorsals well separated; the second dorsal with a depression on the tail; lips moderately fringed. Color olive-brown, mottled with blackish confluent patches; dull brownish below. Size much larger than any of the other species. L. 24 to 36. Atlantic coasts of Europe and North America, chiefly northward, ascending streams in the spring to deposit its spawn.

(Petromyzon marinus L. Syst. Nat.; Günther, viii, 501; Jordan, 348.—Petromyzon americanus Le Sueur, Trans. Am. Philos. Soc. i, 383.—Petromyzon americanus Storer, Fish Mass. 251.)

#### 12. P. nigricans Le Sueur.—Lamper-eel.

Head very large, longer than the "chest", 6½ in length; depth about 13; body little compressed; dorsal fins rather low, distinctly separated; eyes and mouth very large; mandibulary plate with 7 to 9 teeth; the rest of the buccal disk covered with rather large teeth disposed in oblique cross-rows, five or more in each row, some of the innermost bicuspid; anterior as well as posterior lingual teeth pectinate; lips fringed. Coloration nearly plain; bluish black above, pale below, usually a pale spot between the eyes on the top of the head. L. 12. A rather small species found along the Atlantic coasts of our Northern States, and ascending streams in the spring to spawn, some individuals remaining permanently in fresh water. Abundant in Cayuga Lake, N. Y., from which locality the specimens were taken on which the above description was based.

(Petromyzon nigricans Le Sueur, Trans. Amer. Phil. Soc. new series, i, 385; Storer, Fish Mass. 253.—Ammocates fluviatilis Jordan, 349.)

This species is very different from the European Lampetra fluviatilis. It is possibly only a variety of Petromyzon marinus. Numerous other Lampreys have been described from our waters, but we find them unrecognizable.

# CLASS III.—ELASMOBRANCHII.

(The Selachians.)

Skeleton cartilaginous; skull without sutures. Body with median and paired fins; the ventral fins abdominal; shoulder-girdle developed, lyriform; caudal fin heterocercal, the upper lobe produced; gills attached to the skin by the outer margin; gill-openings several, or single leading to several clefts; membrane bones not developed, except sometimes a rudimentary opercle; skin naked or covered with minute imbricated scales or hard plates, sometimes spinous; no air-bladder; arterial bulb with three series of valves; intestine with a spiral valve; optic nerves united by a commissure, not decussating; ovaries with the ova few and large, impregnated, and sometimes developed, internally; embryo with deciduous external gills; males with prehensile intromittent organs, "claspers," attached to the ventral fins. Sharks, Skates, and Chimæras. ( $\frac{1}{2}\lambda a\sigma \mu \hat{\sigma} \sigma_{\tau}$ , a plate or blade;  $\frac{1}{2}\rho \alpha \gamma \chi (a, gills.)$ 

ANALYSIS OF ORDERS OF ELASMOBRANCHS.

- \* Gill-openings slit-like, 5 to 7 in number; jaws distinct from the skull. (Subclass Selachii.)

## SUBCLASS SELACHII.

(The Sharks and Rays.)

Elasmobranchiates with the gill-openings slit-like, five (rarely six or seven) in number; jaws distinct from the skull; no opercular nor pelvic bones; derivative radii sessile on the sides of the basal bones of the limbs, rarely entering the articulation.

As here understood, this subclass is equivalent to the *Plagiostomata* of authors, and includes the orders or suborders *Raiw*, the Rays, and *Squali*, the Sharks; groups which are perhaps hardly worthy of ordinal value. ( $\sigma\xi\lambda\tilde{a}\chi\sigma\varepsilon$ , a shark, from  $\sigma\xi\lambda\tilde{a}\chi\sigma\varepsilon$ , cartilage.)

## ORDER D.—SQUALL

(The Sharks.)

Gill-openings lateral, slit-like, five to seven in number; general form elongate, the body gradually passing into the tail. The typical sharks

and skates differ much from each other in appearance; but intermediate forms connect the two groups closely. The position of the gill-openings is almost the only constantly diagnostic character. (Suborder Scluchoidei Günther, viii, 353–433.) (Latin, squalus, a shark, from the Greek  $\gamma a \lambda z \delta \tau$ , a shark, which comes from  $\gamma a \lambda z \delta \eta$ , a weasel, or other musteline animal, from resemblances in habits.)

#### ANALYSIS OF THE FAMILIES OF SOUALI.

- \* Pectoral fins moderate, without deep notch at the base in front.
- t Anal fin absent.
  - - Spinacidæ, 5.

- tt Anal fin present.
  - b. Dorsal fins two.
    - c. Dorsal fins both without spine.
      - - e. Caudal fin not lunate, its upper lobe many times longer than the lower, with a notch below toward its tip; tail not keeled.
          - f. Last gill-opening above the base of the pectoral.
            - g. Tail moderately developed, forming less than one-third of the total length; eyes with nictitating membranes.
        - ff. Last gill-opening entirely in front of the pectoral. Carcharde. 10. ee. Caudal fin lunate; caudal peduncle with a keel on each side.
          - i. Last gill-opening entirely in front of ventrals.
            - j. Gill-openings moderate; teeth well developed. LAMNID.E., 11.
          - ii. Last gill-opening above the base of the pectoral.

Rhinodontidæ, 13

HEXANCHIDE, 15.

\*\* Pectoral fins very large, expanded at the base in front, this expansion separated from the neck by a deep notch; no anal fin. SQUATINID.E., 16.

## SUPER-FAMILY SCYMNOIDEA.

(The Seymnoid Sharks.)

## Family IV.—SCYMNIDÆ.

(The Sleeper Sharks.)

Sharks with two dorsal fins, both without spine, and no anal fin; fins all small; gill-openings small, entirely in advance of pectorals; mouth

but little arched; a long, deep, straight, oblique groove on each side of it; spiracles present. (The absence of dorsal spines chiefly distinguishes this family from *Spinacidæ*.)

Genera six; species six or more, mostly of the Atlantic. (Günther, *Spinacidæ*, pt. viii, 425–429.)

S.—ECHINORHINUS Blainville, 1816.

outwards ...... Somniosus, 9.

Spinous Sharks.

(Goniodus Agassiz.)

(Blainville, 1816; type Squalus spinosus Gmelin.)

Two very small dorsal fins without spine, the first opposite the ventrals; no anal fins; skin with scattered large round tubercles, surmounted by prickles, like those on a bramble, and, like them, leaving a scar when detached. Month crescent-shaped, a labial fold around the angle of the mouth; nostrils midway between the mouth and the end of the snont. Teeth equal in both jaws, very oblique, the point being turned outwards; several strong denticulations on each side of the principal point. No nictitating membrane. Spiracles small; gill-openings of moderate width. A single species of the East Atlantic, straying to our coast. (ἐχῖνος, a hedgehog, or sea-urchin; ρυη, shark.)

## 13. E. spinosus (Gmel.) Blainv.—Spinous Shark; Bouclé.

"Spiracles behind the eye, behind the vertical from the angle of the mouth. Teeth  $\frac{22-26}{22-26}$ . Dorsal fins close together. Each tubercle with a small spine in the centre. Brownish violet, with or without dark spots" (Günther). A large shark of the coasts of Europe and Africa; a stray individual lately taken on Cape Cod.

(Squalus spinosus Gmelin Linn. 1, 1500; Günther, viii, 428.)

9.—SOMNIOSUS Le Sueur, 1818.

Sleeper Sharks.

(Lamargus Müller & Heule.)

(Le Sueur, Journ. Ac. Nat. Sci. Phila. 1818, i, 222; type, Somniosus brevipinna Le Sueur = Squalus microcephalus Bloch.)

Body elongate; mouth transverse, little arched, with a deep straight groove running backward from its angle; nostrils near the extremity of the snout; jaws feeble; teeth in upper jaw small, narrow, conical; lower teeth numerous, in two or more series, the point so much turned aside that the inner margin forms a cutting edge, which is entire; spiracles moderate; no nictitating membrane; gill-openings narrow; fins all very small, the ventrals nearly opposite the second dorsal; skin uniformly covered with minute tubercles. Species few, of the Northern Seas. (Latin, somniosus, sleepy.)

## 14. S. microcebhalus (Bloch) Gill.—Sleeper Shark; Nurse.

Body robust, rapidly tapering behind; greatest depth about onefifth the length; head somewhat less; mouth moderate, upper jaw with five rows of small sharp teeth, which are incurved and lancet-shaped; lower jaw with two rows of broad, quadrangular teeth, divided in their centres by a perpendicular ridge and directed outwards, about 26 teeth on each side; spiracles small; skin rough; fins small, the first dorsal about as large as the ventrals and larger than the second dorsal; pectorals short; caudal short and bluntish. L. 8 to 20 feet (*Storer*). Cape Cod to the Arctic Seas.

(Squalus microcephalus Bloch, Schn. 135; Somniosus brevipiuna Le Sneur, Journ. Ac. Nat. Sci. Phila. i, 222; Seymnus brevipinaa Storer, Fish Mass. 235; Læmargus borealis Günther, viii, 426.)

## Family V.—SPINACIDÆ.

(The Dog-fishes.)

Body more or less elongate; head depressed; eyes lateral, without nictitating membrane; mouth inferior, rather large, arched; teeth compressed, variously formed; nostrils inferior, lateral, near the front margin of the snont; spiracles moderate; gill-openings moderate, five on each side, all in front of the pectoral fins; dorsal fins two, each armed with a spine; the first dorsal in front of the pectorals; unal fin wanting; caudal fin with the lower lobe small or obsolete; ventral fins inserted posteriorly.

Genera six or more; species about fifteen; rather small sharks, chiefly of the Atlantic. (Spinacidæ, part, Günther, viii, 417-425.)

- \* Teeth equal in both jaws; dorsal spines not concealed.
- \*\*Teeth unequal, those in the upper jaw erect, triangular, those in the lower jaw more or less oblique; dorsal spines hidden beneath the skin. Centroscymnus, 12.

## 10.—CENTROSCYLLIUM Müller & Henle, 1837.

## Black Dog-fishes.

(Müller & Henle, Systematische Beschreibung der Plagiostomen, 191; type Spinax fabricii Reinhardt.)

Teeth equal in both jaws, very small, straight, pointed, each with one or two smaller cusps on each side at base; mouth crescent-shaped, with a straight, oblique groove at its angle; spiracles moderate; gill-openings rather narrow; dorsal fins small, each with a strong spine; the second dorsal entirely behind the ventrals. One species. (κέντρον, spine; σχύλλιον, Scyllium, an allied genus, from σχύλλον, to rend or tear to pieces.)

### 15.—C. fabricii (Reinhardt) M. & H.—Black Dog-fish.

Body covered with minute stellate ossifications; color dark brown. A shark of the Greenland Seas, lately taken off Gloucester, Mass., by the United States Fish Commission.

• (Spinax fabricii Reinhardt, Dansk, Vid. Selsk, Förh, 1828, iii, xvi; Günther, viii, 425.)

### 11.-SQUALUS Linnæus, 1758.

Dog-fishes.

(Acanthias Risso.)

(Artedi, Linnaus, Systema Natura; type Squalus acanthias L.)

Body rather slender; mouth little arched, with a long, straight, deep, oblique groove on each side; no labial fold along the margin of the mouth; teeth rather small, equal in both jaws, their points so much turned aside that the inner margin forms the cutting edge; spiracles rather wide, just behind the eye; gill-openings narrow, in front of the pectorals; fins moderately developed, the first dorsal larger than second, much in advance of the ventral fins, which are behind the middle of the body, although in advance of the second dorsal. Small sharks, abounding in the Temperate Seas. (Latin, squalus, a shark.)

\* Dorsal spine not grooved; its insertion rather behind inner angle of the pectorals.

16 .- S. acanthias L.-Picked Dog-fish; Dog-fish; Bonc Dog; Skittle-dog; Hoe.

Body slender; snout pointed; head 6½ in length; depth about 8; slate-color above, pale below, back with whitish spots, especially in the young. L. 1 to 3 feet; weight 5 to 15 pounds.

A small sharp-toothed shark, ranging widely in the Atlantic, very abundant along the shores of the Northern and Middle States. It is somewhat valued for its livers, from which "Dog-fish" oil is extracted. American writers have usually considered our species (Squalus ameri-

canus (Storer) Gill) as distinct from the European, but no reliable distinctions have been pointed out.

(Squalus acanthias L. Syst. Nat.; Acanthias americanus Storer, Synopsis, 506; Acanthias americanus Storer, Fish Mass. 232; Acanthias rulgaris Giinther, viii, 418. Squalus sucklii (Grd.) Gill, from the Pacific coast of the United States, is considered by Dr. Giinther and others as the same species; Spinax (Acanthias) sucklii Girard, Proc. Ac. Nat. Sci. Phila. 1854, 176; Squalus sucklii Gill, Proc. Ac. Nat. Sci. Phila. 1862, 499.)

## 12.—CENTROSCYMNUS Bocage & Capello, 1861.

(Bocage & Capello, Proc. Zool. Soc. 1864, 263; type Centroscymnus carlotepis Boc. & Cap.)

Dorsal fins each with a *spine*, which is *hidden below the skin*; mouth wide, but little arched; a long, deep, straight, oblique groove on each side of the mouth. Teeth of the lower jaw oblique, with the point more or less directed outwards. Upper teeth lanceolate, on a quadrangular base, with a single cusp. Spiracles wide, behind the eye. Gill-openings narrow. (κέντρον, spine; σκόμενος, an ancient name of some shark, from σκόμενος, a lion's whelp.)

## 17. C. cœlolepis Bocage & Capello.

Labial groove prolonged forwards, but separated by a broad space from that of the other side. Upper teeth very small, narrow and lanceolate. The distance between the nostrils is rather less than  $\frac{1}{2}$  the length of the praeoral portion of the shout. Lower angle of the pectoral rounded, not produced. Dorsal fins short, especially the first, the length of which (without the spine) is only about  $\frac{1}{6}$  its distance from the second. Extremity of the ventrals below the end of the second dorsal. Scales on the head and hape with striæ, the others smooth, with a depression at the base. Uniform blackish brown. (Günther.) Coast of Portugal and neighboring parts of the Atlantic, a specimen taken near Gloncester, Mass.

(Bocage & Capello, Proc. Zool. Soc. 1864, 263; Centrophorus calolepis Günther, viii, 423.)

## SUPER-FAMILY SCYLLIOIDEA.

 $(\ The\ Scyllioid\ Sharks.)$ 

## FAMILY VI.—GINGLYMOSTOMATIDÆ.

(The Nurse Sharks.)

Sharks with the first dorsal above or behind the rentrals; no spines; anal fin present; caudal fin bent upwards, with a basal lobe; mouth inferior, with small teeth, in several series; nostril confluent with the mouth; nasal valves of both sides forming a quadraugular flap in front

Bull. Nat. Mus. No. 16——2

of the month, each being provided with a free cylindrical cirrus; an upper and lower lip, the latter not extending across the symphysis; fourth and fifth gill-openings close together; eyes very small. The backward position of the first dorsal distinguishes this family from all others in our waters. Genera two; species about four; large sharks of the warm seas. (Scullidæ pt. Günther, viii, 407–409.)

### 13.-GINGLYMOSTOMA Müller & Henle, 1837.

(Müller & Henle, Wiegmann's Arch. 1837, p. —: type Squalus cirratus Gmelin.)

The characters of this genus are those of the family above given, with the addition of the following, which distinguish Ginglymostoma from Nebrius: teeth of both jaws in many series, each with a strong median cusp, and one or two smaller cusps on each side.  $(\gamma'\gamma\gamma\lambda\delta\mu\sigma_5, a \text{ hinge or hinge-like joint}; \sigma\tau\delta\mu a, \text{mouth.})$ 

## 18. G. cirratum (Gmel.) M. & H.—Nurse Shark.

Uniform brownish: young specimens with small, scattered, round black spots; nasal cirrus reaching the lower lip; angles of the fins obtusely rounded; caudal fin forming nearly one-third of the total length. L. 6 to 10 feet. (Günther.)

A large shark of the warmer parts of the Atlantic, abundant in the Gult of Mexico and the West Indies, and occasionally taken on our South Atlantic coast.

(Squalus cirratus Gmelin's Linnæus, i, 1492; Müller & Henle, 23; Günther, viii, 408.)

## SUPER-FAMILY GALEORHINOIDEA.

(The Galcorhinoid Sharks.)

## FAMILY VH.—GALEORHINIDÆ

(The True Sharks.)

Sharks with two dorsals and an anal fin; no spines; pectorals moderate; caudal fin not greatly clongated, not lunate, moderately bent upwards, notched toward its end, and with the basal much less developed than the upper; caudal peduncle not keeled; posterior gill-opening above the base of the pectoral fin; eyes with nictitating membranes; head not hammer-shaped, the snout being longitudinally produced as usual among shark's. A large family of twenty or more genera and about

sixty species; found in all seas. (Carchariida part (Carchariina and Mustelina) Giinther, viii, 357–380, and 383–388.)

- $^*$  Teeth flat and paved, without cusps or cutting edges; spiracles present. (Mustelinæ.)
  - a. No pit at the root of the tail: labial folds well developed.......MUSTELUS 14.
- \*\* Teeth more or less compressed, with entire or serrate sharp edges. (Galcorkinina.)

  b. Spiracles present.
  - c. No pit at the root of the tail.

    - dd. Teeth larger, with a single cusp, oblique, notched and serrated,

Galeorhines, 16.

- bb. Spiracles obsolete.
  - e. Teeth serrate, more or less (entire in the very young or very old); little oblique or nearly upright.
    - f. Teeth well serrated (in the adult); those of the upper jaw comparatively broad or triangular; those of the lower narrow and claviform, Carcharinus, 18.
  - ec. Teeth all entire.

#### 14.-MUSTELUS Cuvier, 1817.

#### (Hound Sharks.)

(Bellon, Cuvier, Regne Animal: type Mustelus vulgaris M. & H.)

Body elongate, slender, not elevated; snout comparatively long and flattened; mouth crescent-shaped, with well-developed labial folds; teeth small, many-rowed, flat and smooth, rhombic, arranged like pavement, alike in both jaws; eyes large, oblong; spiracles small, just behind the eyes; pectoral fins large; first dorsal large, not much behind pectorals; second dorsal somewhat smaller; analopposite second dorsal and still smaller; ventrals well developed; basal lobe of candal almost obsolete; embryo not attached to uterns by a placenta. Small sharks, the smallest of the American species, known at once by the smooth, paved teeth. (Latin, mustela, a weasel or martin; the use of the word similar to that of yalta, yaltaôt.)

## 19. M. himmulus (Blainy.) J. & G.—Smooth Horat; Dog Shark.—Emissole.

Body slender, tapering backward from the dorsal fin to the long slender tail; snont depressed, moderately sharp; mouth small, the teeth all alike, a fold at the angle of the mouth; first dorsal rather large, prolonged behind, nearly midway between the pectorals and ventrals; second dorsal smaller, but larger than usual in sharks; anal slightly behind second dorsal, and much smaller; pectoral fins broad and large, reaching past front of dorsal; back slightly keeled. Smallest of our sharks; abandant on the Atlantic coasts of both continents, especially northward. Specimens from Cape Cod and from Venice apparently differ in no important respect.

(Galcorhinus hinnulus Blainville Faune Franc, 1828, 83; Mustelus vulgaris Giinther viii, 386; Mustelus canis Storer, Fish Mass, 227.)

### 20. M. californicus Gill.

First dorsal beginning over terminal third of pectoral; its acute point not reaching to insertion of ventrals; anterior angle of dorsal blunt; second dorsal similar to first, but smaller; snout rather more pointed than in most of the species. D. 18 + 17; A. 18; P. 22. Coast of California. (Gill.) Scarcely different from the preceding.

(Gill, Proc. Ac. Nat. Sci. Phila, 1864, 148.)

#### 15.—TRIACIS Müller & Henle, 1838.

(Rhinotriacis Gill.)

(*Triakis* Müller & Henle, Magazine of Natural History, vol. ii: type *Triakis scyllium* Müller & Henle.)

Body compressed, elongate; month large, crescent-shaped, with well-developed long labial folds; teeth small, numerous, similar in both jaws, each with a longer median cusp, and one or two smaller ones on each side; eyes small, with nictitating membrane; spiracles small, behind the eyes; no pit at the root of the candal; no lower lobe to the caudal; first dorsal fin opposite the space between the pectorals and ventrals. Pacific and Indian Oceans.  $(\tau \rho z \bar{z} \bar{z}, \text{three}: \dot{a} z \bar{z}, \text{point.})$ 

#### 21. T. semifascintus Grard.-Dog Shark.

"Snout moderately produced, rounded. Nostril with a broad anterior flap. The first dorsal fin is nearly midway between the pectorals and ventrals, the second is not much smaller than the first, and nearly in advance of the anal. Upper parts with well defined black cross bands, narrower than the interspaces. A row of rounded black spots along the sides of the body, alternating with the interdorsal cross bars. Coasts of California." (Günther.)

(Girard, Proc. Ac. Nat. Sci. Phila, 1854, 196; Günther, viii, 284.—Mustelus felis Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 18.)

#### 22. T. hemlei (Gill) Putnam.

Color uniform reddish brown above, pale below, the pectoral, ventral, and anal fins margined with paler; snout produced, slender; otherwise

essentially as in the preceeding (Gill). California. A single young specimen known.

(Rhinotriacis Lealei Gill, Proc. Ac. Nat. Sci. Phila, 1862, 486.)

#### 16.-GALEORHINUS Blainville, 1816.

## Topes.

(Galcus Cuvier, 1817.)

(Blainville, 1816: type Squalus galeus L.)

First dorsal opposite the space between the pectorals and ventrals; mouth crescent-shaped, with the teeth alike in both jaws, oblique, notched, and serrated; spiracles present, small; nictitating membrane present; no pit at the base of the caudal fin; caudal fin with a single notch. Tropical seas.  $(\gamma a\lambda \ell \sigma_5, a \text{ kind of shark colored like a weasel}; \dot{\rho} \epsilon \sigma_5$ , shark.)

#### 23. G. galeus (L.) Blainy.—Tope,

A short labial fold on both jaws; teeth  $\frac{34}{34}$ . Second dorsal fin only one-third the size of the first and somewhat in advance of the anal. Length of tail nearly equal to distance between dorsals. (Günther.) Europe to the Indian Ocean. "San Francisco." (Günther.)

(Squalus galeus L. Syst. Nat.; Galeus vanis Günther, viii, 379.)

#### 17.—GALEOCERDO Miller & Henle, 1837

### Tiger Sharks.

(Müller & Henle, Wiegmann's Archiv, 1837: type Galeoccedo tigrinus Müller & Henle,)
Mouth crescent-shaped; teeth nearly equal in both jaws, oblique, serrated on both margins, with a deep notch on outer margin; spiracles
present; candal fin with a double notch; a pit on the tail above and
below at the base of the candal fin; first dorsal opposite the space between pectorals and ventrals. Large sharks, found in most seas. (γαλεός,
a kind of shark, marked like γαλέη, the weasel; zερδώ, a fox or weasel;
zέρδως, craft.)

## 24. G. tigrinus Müller & Henle.—Tiger Shark.

Color brown, with numerous dark spots larger than the eye; caudal fin forming about one third of the total length, much longer than the space between the dorsal fins; second dorsal somewhat in advance of the anal; a long labial fold along the upper jaw. (Günther.) Cape Cod to Indian Ocean; a rather large shark, known by its variegated coloration.

(Miiller & Henle, 59; Günther, 378.)

#### 18.- CARCHARINUS Blainville, 1816.

Rhie Sharks

(Cynocephalus Klein, Gill.) (Carcharius Cuvier, not of Rafinesque.) (Prionodon Müller & Henle.) (Eulamia Gill.)

(Blainville 1816: type Carcharinus commersoni Blainville.)

Large sharks, without spiracles, with the teeth in both jaws strongly serrated in the adult, those in the upper jaw broad, those below narrower, straight, and claviform; first dorsal large; second dorsal much smaller, usually not larger than the anal. Species numerous in the tropical seas. (zάρχαροτ, rough; ρ΄ωη, shark; abbreviated from Carcharorhinus.)

\* Body and head slender; dorsal fin inserted midway between pectorals and ventrals (Carcharinus).

#### 25. C. glaneus (L.) Jor, & Gilb.—Great Blue Shark.

"Snout very long, nostrils rather nearer to the mouth than to the extremity of the snout; no labial fold except a groove at the angle of the mouth; teeth of the upper jaw oblique, scarcely constricted near the base; lower teeth slender, triangular in young examples, lanceolate, with a broad base, in old ones. Pectoral fin long, falciform, extending to the dorsal, which is nearer the ventrals than the root of the pectorals." (Günther.) A large shark of the warm seas, occasionally taken on our coast.

(Squalus glaucus L. Syst. Nat.; Carcharias glaucus Gnnther, viii, 364.)

\*\* Body and head stont; dorsal fin placed close behind the root of the pectorals (Eulamia Gill).

#### 26. C. obscurus (Le Sneur) J. & G.—Dusky Shark.

Dark clear blue above, white below; head rather pointed, flattened above and below; first dorsal rather large; second smaller than the anal, and considerably produced behind; pectorals large, falciform. A large shark, reaching a length of nine or ten feet, inhabiting the North Atlantic and frequently taken on our coast.

 $(Squalus\ obscuras\ Le\ Snenr,\ Journ.\ Ac.\ Nat.\ Sci.\ Phila.\ 1818,\ i,\ 223\ ;$   $Carcharias\ obscurus\ Günther,\ viii,\ 366.)$ 

#### 27. C. milberti (Müller & Henle) Jor. & Gilb.—Blue Shark.

This species is represented as having the snout shorter, blunter, and

higher than in the preceding, and with the pectoral fins considerably shorter and broader, not reaching half way to the ventrals.

Cape Cod to the Mediterranean Sea.

(Carcharias (Prionodon) milberti M. & H. 38; Gill, Proc. Ac. Nat. Sci. 1864, 262.—Carcharias caruleus DeKay, 349; Lamna caudata DeKay, 354.)

#### 27. b. C. lamia (Risso) Jor. & Gilb.

This species was provisionally identified by Prof. Putnam from a tooth obtained on St. Peter's Bank belonging to a fish estimated to have been at least thirteen feet in length. (Goode and Bean.) In this species the upper teeth are little oblique, serrated, broad, and regularly triangular; dorsal large; the second dorsal smaller than the anal; teeth  $\frac{27-31}{27-30}$  (Günther.)

(Carcharius lamia Giinther viii, 372; Prionodon lamia Goode & Bean, Bull. Essex Inst., 1879, 30.)

### 19.-ISOGOMPHODON Gill, 1861.

## Sharp-nosed Sharks.

(Gill, Ann. Lyc. Nat. Hist. N. Y. vii, p. 410: type Carcharias (Prionodon) oxyrhynchus Müller & Henle.)

This genus differs from Eulamia principally in the dentition; the teeth are similar in form in both jaws, constricted at the base, claviform and straight, their edges searcely serrated; the snout is slender and rather conic and pointed. Large sharks, of the tropical seas. (¿σος, equal; γόμφος, a nail, or peg; δδῶν, tooth.)

#### 28. I. limbatus (Müller & Henle) Gill.—Spotted-fin Shark.

"Snout somewhat pointed in front, rather produced, the distance between its extremity and the mouth being somewhat less than the width of the mouth; nostrils nearly midway between the extremity of the snout and the mouth; teeth  $\frac{25-29}{27-30}$ , similar in form in both jaws, namely, erect, constricted, on a broad base, the upper more distinctly serrated than the lower; gill-openings wide, at least twice as wide as the eye, which is small; pectorals falciform, extending beyond the end of the dorsal, the length of their upper margin being nearly four times that of the lower. First dorsal commencing very close behind the axil of the pectoral; origins of the second dorsal and anal opposite to each other, the bases of both being nearly equally long. Candal fin long, with the upper edge slightly undulated, its length being equal to the distance between the origins of the two dorsal fins. The lower side of the extremity of the pectoral, and the extremities of the second dorsal and

anal, and of the lower caudal lobe black". (Günther.) Tropical seas; a stray specimen taken at Wood's Hole, Mass.

(Carcharias (Prinodon) limbatus M. & H., 49; Carcharias limbatus Günther, viii, 373.)

#### 20.-APRIONODON Gill, 1861.

### Smooth-toothed Sharks.

Aprion Müller & Henle, preoccupied.)

(Gill, Ann. Lyc. Nat. Hist. N. Y. vii, 411: type Squalus punctatus Mitch.)

Snont more or less produced and conic; teeth entire, without serræ or basal cusps, all of them narrowed on a broad base, the lower erect, the upper erect or only slightly oblique; dorsal more or less posterior, opposite the space between pectorals and ventrals. (a, privative;  $\pi\rho i\omega z$ , saw;  $\partial \partial \omega z$ , tooth; the edges of the teeth being always entire.)

#### 29. A. DEED CERTERS (Mitch.) Gill.—Smooth-toothed Shark.

"Distance of the extremity of the snout from the mouth equals that between the nostrils. Pectoral fin subfalciform, extending to the end of the dorsal. Second dorsal much smaller than the first." (Günther.) Atlantic; probably not common on our coast.

(Squalus punctatus Mit. Lit. & Phil. Trans. N. Y. i, 483; Carcharias isodon M. & H. 32; Carcharias punctatus Günther, viii, 361.)

#### 21.- SCOLIODON Müller & Henle, 1837.

#### Oblique-toothed Sharks.

(Müller & Henle, Wiegmann's Archiv f. Naturg, iii: type Scoliodon laticandus M. & H.)

Sharks with the teeth entire, oblique and flat, the points directed toward the sides of the mouth, so that the inner margins are nearly horizontal, and present a smooth cutting edge, those in front more nearly erect; teeth not swollen at the base; each of them with a deep notch on the outer margin below the sharp point; no spiracles; a pit at base of tail; first dorsal well in front of ventrals, much larger than second. (σχολιός, twisted or crooked; ὁδὰν, tooth.)

## 30. S. terre-novæ (Richardson) Gill.—Sharp-nosed Shark.

Body slender; snout depressed, moderately rounded; mouth **U**-shaped, with a short labial groove at its angle, which groove extends on the upper jaw as well as on the lower; distance between nostrils greater than distance from nostrils to end of snout; gill-openings narrow; first dorsal moderate, midway between pectorals and ventrals; second dorsal very small, slightly behind, and rather smaller than the anal; anal fin much shorter than distance from anal to ventrals; a slight furrow along

the middle line of the back, ending in a pit at the root of the tail; pectoral fins rather large; ventrals small. Color gray; caudal fin with a conspicuous narrow blackish edge. Newfoundland to South America; common southward. Size rather small.

(Squalus (Carcharias) terra-nova Richardson, F. B. A. iii, 289; Carcharias terra-nova Giinther, viii, 360.)

## FAMILY VIII.—SPHYRNIDÆ.

(The Hammer-headed Sharks.)

General characters of the Galcorhinidæ, but the head singularly formed, kidney-shaped or "hammer"-shaped from the extension of its sides, the nostrils being anterior and the eyes on the sides of the "hammer"; mouth crescent-shaped, under the "hammer"; the teeth of both jaws similar, oblique, each with a notch on the outside near the base; no spiracles; last gill-opening over the pectorals; first dorsal and pectorals large, the dorsal nearer pectorals than ventrals; second dorsal and anal small; a pit at the root of the caudal; caudal fin with a single notch toward its tip, its lower lobe developed. Genera 3; species 5; inhabiting most seas. Large sharks, known at once by the singular form of the head. (Carcharidæ, part: group Zygænina Günther, 380–383.)

\*Nostrils near the eyes.

a. Nostrils simple, with the frontal grooves radimentary or obsolete; head reniform, its anterior and lateral margins confluent, forming a semicircle.

RENICEPS, 22.

#### 22.—RENICEPS Gill. 1861.

#### Bonnet-headed Sharks.

(Gill, Ann. Lye. Nat. Hist. N. Y. 1861, viii, p. 412: type Squalus tiburo L.)

Head reniform, the anterior and lateral margins confluent, forming a regular semicircle, the posterior margins of the sides of the hammer very short; nostrils close to the eyes, with the grooves indistinct. (Latin, rena, kidney; ceps, head.)

31. R. tiberro (L.) Gill. - Shovel-head Shark; Bonnet Head.

Body rather slender, not much compressed; head depressed, semicircular in front, reniform, the posterior free margins short, the lateral margins continuous with the anterior; pectorals large; first dorsal high, midway between pectorals and ventrals; second dorsal much smaller, produced behind, higher and shorter than anal; ventral fins moderate; candal moderate; mouth small, crescentic; teeth small, very oblique, with a deep notch on the outer margin. Color uniform ashy, paler

beneath; head 4\frac{1}{3} in length, 6 to tip of caudal; width of head slightly less than length of head. L. 3 to 6 feet or more. Atlantic Ocean; abundant southward: ranging to China.

(Squalus tiburo L. Syst. Natura : Zygwna tiburo Günther, viii, 382.)

#### 23.-SPHVRNA Rafinesque, 1810.

#### Hammer-head Sharks.

(Cestracion (Klein) Gill; Zygana Cuvier; preoccupied.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc.: type Squalus zygæna L.)

Head truly "hammer"-shaped, the anterior, lateral, and posterior margins distinct; nostrils near the eyes, the openings confluent with a groove, which extends along most of the front margin of the head. Species few, reaching a large size; found in all warm seas. ( $\sigma\varphi\delta\rho a$ , a hammer.)

#### 32. S. zvgaena (L.) M. & H.-Hammer-headed Shark.

Width of head about twice its length; first dorsal large; second quite small, smaller than anal; pectorals rather large; color gray. A large shark, found in all warm seas; common on our coast from Cape Cod southward.

(Squalus zygwna L. Syst. Naturae: Zygwna malleus Günther, viii, 381: <sup>\*</sup>Zygwna malleus Storer, Fish Mass, 238.)

## SUPER-FAMILY LAMNOIDEA.

(The Lamnoid Sharks.)

## FAMILY IX.—ALOPHDÆ.

(The Thresher Sharks.)

Body moderately elongate; the snout rather short; mouth crescent-shaped; teeth equal in both jaws, moderate sized, flat, triangular, not serrated; the third tooth of the upper jaw on each side much smaller than the others; gill-openings moderate, the last one above the root of the pectorals; no nictitating membrane; spiracles just behind eye, minute or absent; first dorsal large, midway between pectorals and ventrals; second dorsal and anal very small; caudal fin exceedingly long, about as long as the rest of the body, a pit at its root, a notch on the upper lobe near its tip; lower lobe moderately developed; no caudal keel; ventrals rather large; pectorals very large, falcate. A single species, reaching a large size, inhabiting most seas; known at once by the great length of the caudal fin. (Lamnidæ, part, Günther, viii, p. 393; genus Alopecias.)

#### 24.—ALOPIAS Rafinesone, 1810.

#### Thresher Sharks.

(Alonecias Müller & Henle; corrected orthography.)

(Rafinesque, Caratteri di Alcuni N. Generi, etc.: type Alopias macrourus Raf. = Squalus rulnes Gmelin.)

The characters of the genus are included above. ( $\partial \lambda \omega \pi \delta \tau$ , a fox; Latin, rulpes. A. rulpes was known to the ancients as  $\partial \lambda \omega \pi \varepsilon z (a \tau = \text{fox-like.})$ 

33. A. vulpes (Gmel.) Bonap.—Thresher; Fox-Shark; Swingle-tail; Long-tail Shark.

A large shark, abounding in all warm seas, especially in the Mediterranean and Atlantic. It is also occasionally taken on our Pacific coast. Known at once by the great length of the tail.

(Squalus rulpes Gmelin, Linn, Syst. Nat. i, p. 496; Alopecias vulpes (Günther, viii, 393.)

## FAMILY X.—CARCHARIIDÆ.

(The Sand Sharks.)

Body rather elongate, the snont sharp; mouth crescent-shaped, wide; the teeth large, long, and narrow, subulate, most of them with one or two small cusps at the base, their edges entire; gill-openings rather large, all of them in front of the pectorals; two dorsals, moderate, subequal, the anal similar; fins, dorsal well behind pectorals; caudal well developed, with a short basal lobe and a notch toward its tip; no candal keel; pectorals rather short; no nictitating membrane; spiracles minute, pore-like. Genera 1 or 2, Carcharias Raf. (=Odontaspis Ag.; not Carcharias Cav.=Carcharinus) and "Eugomphodus"; species 3. Voracious sharks of moderate size, chiefly inhabiting the Atlantic. (Lamnidæ, part, Günther, viii, 392; genus Odontaspis.)

#### 25.—CARCHARIAS Rafinesque, 1810.

## Sand Sharks.

(Odontaspis Agassiz.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc.: type, and only species mentioned, Carcharias taurus Raf.)

Characters of the genus included above. (zápzapoz, rough.)

- \* First and fourth teeth of the upper jaw and first tooth of the lower simple, without basal ensps. (Eugomphodus Gill.)
- 34. C. americanus (Mitch.) Jor. & Gilb.—Sand Shark: Shovel-nose.

Body elongate, its depth one fifth the length; head rather pointed, about one seventh of the length; fins small, the first dorsal not much

larger than the second, both similar to the anal; pectoral fins short, obtuse, or truncate; color gray. L. 4 to 6 feet.

A small voracious shark with very sharp teeth, rather common on our Atlantic coast.

(Squalus americanus Mitch, Trans. Lit. & Phil. Soc. 1814, i, 483; Squalus littoralis Mitch, Am. Monthly Mag. ii, 1818, 328; Carcharias griseus Storer, Fishes Mass. 217; Odontaspis americanus Giinther, viii, 392; Eugomphodus littoralis Gill, Proc. Ac. Nat. Sci. Phila. 1864, 260.)

## FAMILY XI.—LAMNIDÆ.

(The Porbeagles.)

Sharks of large size, with the body stout, the mouth wide, with large teeth, and the caudal fin lunate, the two lobes being not very unequal, the upper lobe strongly bent upward; candal peduncle with a keel on each side; gill-openings wide, all in front of the pectorals, entirely lateral, not extending under the throat; first dorsal large; pectorals large; ventrals moderate; second dorsal and anal very small; a pit at the root of the caudal; spiracles minute or absent. Genera 3; species 6 or more. Those inhabiting our coasts have been much confused by authors. (Lannidae, part, Giinther, viii, 389–392.)

\*Teeth with entire edges.

#### 26.-ISURUS Rafinesque, 1810.

## Porbeagles.

#### (Oxyrhina Ag.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi: type Isurus o.cyrhynchus Raf.=Oxyrhina spallanzanii Bon.)

Snont rather long and pointed; first dorsal and pectorals large; second dorsal and analyvery small; caudal peduncle slender; teeth long, lanceolate, with sharp entire cutting edges and no basal cusps. (१७०६, equal; ٥٥ρα, tail; the two lobes of the tail being nearly equal, as in all the members of this family.)

\* First dorsal inserted entirely behind pectorals, nearly midway between pectorals and ventrals. (Isuropsis Gill.)

### 35. I. glaucus (M. & H.) Jor. & Gilb.-Mackerel Shark.

This species, if really occurring on our coast, will be known from the other *Isuri* by the position of the dorsal, which is distinctly behind the

pectorals, nearly midway between them and the ventrals. This position is represented in DeKay's figure (Nat. Hist. N. Y. Fishes, pl. 63, fig. 206). Atlantic Ocean; Cuba (*Pocy*).

(Oxyrhina glanca Miiller & Henle, 69: Lamna punctata DeKay (not of Mitchill), 352: Isuropsis dekayi Gill, Ann. Lyc. N. Y. viii, 153: Lamna glanca Giinther, viii, 391.)

 $^{**}$  Dorsal fin inserted close behind the root of the pectorals, much nearer pectorals than ventrals. (Isuvus.)

#### 36. I. oxyrhynehus Raf.—Sharp-nosed Shark; Mackerel Shark.

"Praeoral portion of the snout as long as the longitudinal axis of the cleft of the mouth, tetrahedral, pointed. Angle of the mouth midway between the gill-opening and nostril. Teeth  $\frac{13}{11}$  on each side; long, lanceolate, with sharp lateral edges, without basal cusps. The third tooth on each side of the upper jaw is much smaller than those next to it. Gill-openings extremely wide, the width of the first being rather more than its distance from the last. Origin of the dorsal fin at a very short distance from the base of the pectorals, which are falciform, the length of their lower margin being one-fourth of that of the upper." (Günther.)

(Storer's figure of "Lamna punctata" (Fish. Mass. pl. 37, f. 1) represents, so far as the position of the dorsal is concerned, the present European species, instead of the preceding. No mention is made of the presence of lateral cusps on the teeth. The occurrence of a true Isurus on our coast does not seem, however, to have been verified, although it is not improbable.)

(Lamna punctata Storer, Fish. Mass. 225: Lamna spallanzanii Günther, viii, 390: Isurus oxyrkynchus Raf. Caratteri, etc.)

#### 27.—LAMNA Cuvier, 1817.

#### Perbeuales.

(Cuvier, Regne Animal, ii: type Squalus cornubicus Gmelin.)

Body short and stout, the back considerably elevated; snout prominent, pointed; teeth triangular, pointed, entire, each one with a small cusp on each side at base; (one or both of these sometimes obsolete in the young on some of the teeth;) gill-openings wide; dorsal and pectoral fins somewhat falcate; second dorsal and anal fins very small, nearly opposite each other; first dorsal close behind the root of the pectorals. ( $\lambda \dot{a} \mu \nu a$ , a kind of shark, from  $\lambda \dot{a} \mu \nu \ddot{a}$ , a horrible anthropophagous monster, into which a daughter of Belus was changed by Juno, because she was beloved by Jupiter; a bugbear used by the Greeks to frighten refractory children.)

37. L. cornubica (Gmel.) Fleming.—Beaumaris Shark; Porbcagle: Tope.

Snout conical, pointed, rather longer than the cleft of the mouth; teeth  $\frac{12}{11}$  or  $\frac{11}{10}$  on each side ( $\frac{13}{12}$  or  $\frac{16}{14}$  in European specimens, fide Günther); the third tooth on each side in the upper jaw small; first dorsal beginning over the axil of the pectorals; color gray. A large and fierce shark of the North Atlantic, not till lately recorded from our coast. (A specimen in the Museum of Butler University, from which the above account was taken, was obtained by Dr. T. H. Bean at Wood's Høle, Mass.)

(Squalus cornubicus Gmelin, L. i, 1497; Günther, viii, 389.)

#### 28.—CARCHARODON Smith, 18-..

Great White Sharks.

(Sir Andrew Smith, Proc. Geol. Soc. London, —: type  $Carcharodon\ capensis\ Smith = C.$  rondeleti.)

This genus differs from *Isurus* chiefly in the dentition, the teeth being large, flat, erect, regularly triangular, their edges serrated; first dorsal moderate, nearly midway between pectorals and ventrals; second dorsal and anal very small; pectoral large, ventrals moderate; caudal peduncle rather stout; spiracles minute or absent. Sharks of very large size; found in most seas. (zάρχαρος, rough; δόὸν, tooth.)

#### 38. C. rondeleti Müller & Henle. - Man-eater Shark; Atwood's Shark.

Body stout, depth about  $5\frac{1}{2}$  in total length; mouth very large; both jaws with five rows of large, triangular, serrated teeth, those in the lower jaw narrower, about  $\frac{24}{22}$  in each row; first dorsal somewhat behind pectorals; caudal fin large and strong. Color leaden gray; tips and edges of pectorals black (*Storer*). One of the largest of the sharks, reaching a length of fifteen feet and the weight of nearly a ton. It is found in all temperate and tropical seas, but is rare on our coasts. American specimens have been named C atwoodi, but are probably not distinct from the European.

(Müller & Henle, Plagiostomes, 70; Günther, viii, 392; Carcharias atwoodi Storer, Fishes Mass, 222.)

## FAMILY XIL—CETORHINIDÆ.

(The Basking Sharks.)

Sharks of immense size, with the gill openings extremely wide, extending from the back nearly to the median line of the throat; all of them in front of the pectorals; mouth moderate, the teeth very small,

numerous, conical, without cusps or serratures: no nicitating membran; spiracles very small, above the corners of the month; first dorsal large, midway between pectorals and ventrals; second dorsal and anal small; caudal fin lunate, the upper lobe considerably the larger; caudal peduncle keeled; pectorals and ventrals large. A single genus, with probably but one species; the largest of living sharks; inhabiting the northern seas. (Lamnida, part, Günther, viii, 394; genus Sclache.)

### 29.—CETORHINUS Blainville, 1810.

Basking Sharks.

(Selache Cuvier.)

(Blainville, Bull. Soc. Philom. 1810, p. 169; type Cetorhinus gunueri Blainv. = Squalus maximus L.)

The characters of the genus are included above. ( $z\tilde{\eta}\tau\sigma\tau$ , whale;  $\tilde{\rho}\tilde{\nu}\sigma$ , a shark ( $Squ\tilde{a}tina$ ), from  $\tilde{\rho}\tilde{\nu}\sigma$ , a file or rasp, the rough skin of the shark being used for polishing wood and marble.)

### 39. C. maximus (L.) Blainville.—Basking Shark.

Body rugose, the skin very rough, with small spines; head small; snout blunt; eyes small; teeth in six or seven rows in each jaw, about 200 in each row; first dorsal large, triangular, over the space between pectorals and ventrals; second dorsal much smaller, rather larger than anal; tail large. Largest of the sharks, reaching a length of nearly forty feet; found in the Arctic seas; straying southward to Portugal and Virginia.

(Squalus maximus L. Syst. Nat.: Selachus maximus Storer, Fish. Mass. 229: Selache maxima Giinther, viii, 394.)

## FAMILY XIII.—RHINODONTIDÆ.

(The Whale Sharks.)

Origin of the first dorsal fin somewhat in advance of the ventrals; the second small, opposite to the anal; both without spines; a pit at the root of the candal, with the lower lobe of the candal well developed; sides of the tail with a keel; no nicitating membrane; spiracles very small; month and nostril near the extremity of the snont; teeth very small and numerous, conical; gill-openings wide, the last one above the base of the pectorals. Large sharks, of warm seas. Two species are known, *Rhirodon typicus* from the Cape of Good Hope, and the following. (*Rhinodontida* Giinther, viii, 396.)

## 30.-MICRISTODUS Gill, 1865.

(Gill, Proc. Ac. Nat. Sci. Phila. 1865, 177: type Micristodus punctatus Gill.)

This genus is known from its teeth only. These are described as follows: "The teeth are fixed and extremely minute, the largest little more than a line in length (in a shark 20 feet long) and decrease towards the ends of the jaw; they are disposed in regularly transverse rows, of which there are 164 to 167 on each side, while in front there are 13 to 16 in each transverse row; each tooth is recurved backwards and acutely pointed, swollen and with a heel-like projection in front rising from its base."—(Gill.) (μαρός, small; ἰστός, an upright projection; ἀδοὸς, tooth.)

## 40. M. punctatus Gill.

A very large spotted shark found in the Gulf of California. (Gill, Proc. Ac. Nat. Sci. Phila. 1865, 177.)

## FAMILY XIV.—HETERODONTIDÆ.

(The Port Jackson Sharks.)

Sharks with two dorsal fins, both provided with spines; the first dorsal opposite to the space between pectorals and ventrals; the second in advance of the anal. Body elongated, obtusely trihedral, gradually tapering from the anal region towards the eaudal fin; head high, with the forehead declivous, little prominent; nostrils confluent with the mouth; mouth rather narrow, the upper lip divided into seven lobes, the lower with a fold; spiracles small, below the lower part of the eye; no nictitating membrane; gill-openings rather narrow; dentition similar in both jaws, viz, small obtuse teeth in front, which in the young are pointed, and provided with three to five cusps; the lateral teeth large, pad-like, twice as broad as long, arranged in oblique series, one series being formed by much larger teeth than those in the other series; caudal fin moderate. Genera 1, 2, or 3; species about 4; inhabiting the Pacific Ocean. Of much interest to palæontologists from their supposed relation to certain extinct types. (Cestraciontida Giinther, viii, 417, 418; but Heterodontus has priority over Cestracion.)

#### 31.—GYROPLEURODUS Gill, 1862.

(Gill, Proc. Ac. Nat. Sci. Phila, 1862, 489; type Cestracion francisci Girard.)

The characters distinguishing this group from *Heterodontus* are thus given by Professor Gill:

"In the latter genus, the branches of the lower jaw are at first contiguous and diverge from each other at an acute angle, while in front of the oblique whorls of molars, and between the acute teeth of the front which encroach on the sides, a cordiform area exists. The lateral or molar teeth are numerous, and arranged in oblique whorls, which rapidly increase in size to the fifth, behind which they again decrease. The branchial apertures are also comparatively large, the first being longer than the length of the branchial region.

"In *Gyropleurodus*, the branches of the lower jaw are widely separated by an interval rounded in front and becoming wider behind, the sides themselves being curved outwards; the acute teeth are confined to the front and the molar teeth are few and disposed in about four whorls, the first three of which slightly increase, while the fourth is almost rudimentary. The branchial area is almost oblong."

Head short and high, broad, but with subvertical sides; the forehead very declivous from eyes, and with the snout wide and transverse, but prominent; two blunt, diverging ridges are continued from each side of the snout and abruptly merge into the more conspicuous superciliary ridges, the interval between which is nearly plane; teeth in front digitated, with three or four cusps, quincuncially distributed in rows slightly converging toward the middle; in the upper jaw, on the sides, molars oblong and flattened, arranged in about four oblique whorls, uniform or increasing backward, except the last, which is smallest; on the sides of the lower jaw, also, are molars oblong, with flattened crowns, and arranged in transversely oblique whorls, but decreasing backward (Gill). One species known. ( $\gamma \delta \rho \sigma \tau$ , ring or whorl;  $\pi \lambda \varepsilon \nu \rho \delta \nu$ , side;  $\delta \delta \omega \delta \tau$ , tooth.)

#### 41. G. francisci (Grd.) Gill.

Dorsal fins considerably produced backward at their posterior angle; the compressed spine forming about half of the base of each fin; anal fin large, directed very obliquely backwards, reaching the root of caudal; caudal fin forming about one fourth of the length; color brownish, variegated with sparsely scattered small black spots all over the body and fins. Coast of California (Gill).

(Cestracion francisci Girard, Proc. Ac. Nat. Sci. Phila. 1854, 196; Cestracion francisco Günther, viii, 416; Gill, Proc. Ac. Nat. Sci. Phila. 1862, 492.)

Bull. Nat. Mus. No. 16—3

## FAMILY XV.—HEXANCHIDÆ.

(The Cow Sharks.)

Body elongated, somewhat depressed anteriorly, tapering towards the caudal fin. Head depressed, oblong and semi-oval or semi-elliptical above, with the snont projecting. Eyes submedian or anterior, without nictitating membranes. Month inferior, large, arched in front, no labial fold. Teeth in the two jaws unlike; in the upper jaw one or two pairs of awl-shaped teeth, the next six teeth broader, and each provided with several cusps, one of which is much the strongest. Lower jaw with six large comb-like teeth on each side, besides the smaller posterior teeth. Spiracles small, on the side of the neck. Only one dorsal fin, without spine, opposite the anal, and similar to it. No pit at the root of the caudal fin. Gill-openings wide, six or seven in number. Genera 2; species 4 or more; mostly of the Eastern Atlantic. (Notidanidae Günther, viii, 397–399.)

## 32.—HEPTANCUS Rafinesque, 1810.

#### Perlons.

(Notidanus Cuvier, 1817.)

(Heptranchias Rafinesque, Caratteri di Alcuni Nuovi Generi, etc.: type Squalus cinereus Gmelin.)

Characters same as those of the family with the addition of *gill-openings seven*, which separates this genus from *Hexancus*. ( $\xi \pi \tau \dot{a}$ , seven;  $a\gamma z o \tau$ , bend or sinus, for gill-opening.)

\* Median tooth of lower jaw without central cusp. (Notorhynchus Ayres.)

### 42. H. indicus (Cuvier) Müller & Henle.

"Snout short and rounded; eleft of the mouth broader than long. A single median pointed tooth in the upper jaw; the lower median tooth with lateral cusps, but without central cusp. The first cusp of the lower teeth is much stronger than the others and serrated on its outer margin."—(Günther.) Dark blnish gray, with many small irregular black blotches. Tail more than one third of total length. Size large. Cape of Good Hope to California; not rare at San Francisco.

(Notidanus indicus Cuvier, Regne Animal: Notidanus indicus Günther, viii, 398: Notorhynchus maculatus Ayres, Proc. Cal. Nat. Sci. i, 72: Notorhynchus maculatus Gill, Proc. Ac. Nat. Sci. Phila., 1862, 495, and 1864, 149: Notorhynchus borealis Gill, Proc. Ac. Nat. Sci. Phila. 1864, 150.

## SUPER-FAMILY SQUATINOIDEA.

(The Squatinoid Sharks.)

## FAMILY XVI.—SQUATINIDÆ.

(The Angel Sharks.)

Ray-like sharks. Body depressed and flat; month anterior; teeth conical, pointed, distant; pectoral fins very large, expanded in the plane of the body, but free from it, being deeply notched at the base; ventral fins very large; two small subequal dorsal fins behind the ventrals; no anal fin; candal fin small; gill-openings wide, subinferior, partly covered by the base of the pectoral; spiracles wide, crescent-shaped; behind the eyes; nostrils on the front margin of the snout, with skinny flaps. A single genus, with perhaps but one species. Sharks of singular appearance, inhabiting most seas. (*Rhinida* Günther, viii, 430.)

### 33.—SQUATINA Duméril, 1806.

Angel Sharks.

(Rhing Klein.)

(Aldrovandi, Duméril, Zool. Anal. 1806, : type Squalus squatina L. = Squatina augelus Dum.)

The characters of the genus are included above. (Squatina, the Latin name of S. augelus, from squatus, skate.)

### 43. S. angelus Duméril.—Angel-fish; Monk-fish; Angel Shark.

Bluish ash-gray above, much blotched and speckled; beneath white; caudal fin short triangular, lower lobe longest; dorsal fins short and high; skin rough, with small stiff prickles, largest along the middle line of the back; eyes small. A small shark, with expanded pectorals, like a ray, found in most warm seas, not very common on our coasts. Our species has been generally considered as distinct from the European, under the name *S. dumerili*, but without evident reason. A species considered by Dr. Günther to be identical with *Squatina angelus* also occurs on our Pacific coast.

(Squalus squatina L. Syst. Nat.: Squatina angelus Duméril, Zool. Anal. 102: Squalus dumerili Le Sueur, Journ. Ac. Nat. Sci. Phila. i, 225: Rhina squatina Günther, viii, 430: Squatina californica Ayres, Proc. Cal. Ac. Nat. Sci. 1859, 29.)

## ORDER E.—RALÆ.

(The Rays.)

Gill-openings inferior, slit-like, five in number; spiracles present; no anal fin; dorsal fins, if present, inserted on the tail; body typically disk-like, broad and flat, the margin of the disk being formed by the expanded pectorals. Tail comparatively slender, the caudal fin small. With the exception of the *Raiidæ*, most or all of the rays are ovo-viviparous. (Suborder *Batoidei* Günther, viii, 434–498.) (Latin, *raia* or *raja*, a ray.)

- \* Tail comparatively thick, usually with rayed dorsal and caudal fins; no serrated caudal spine nor separate cephalic fins. (Pachyura.)
  - a. Snout saw-like, much produced, armed with strong lateral teeth .. Pristide, 17.

    - bb. Disk abruptly contracted at base of the tail.
- cc. Electric organs absent; disk and tail more or less prickly ...... RAHD.E, 20.
  \*\* Tail very slender, whip-like, its fins, if any, small and near its base. (Masticura.)
  - d. Pectoral fins uninterrupted, confluent around the snont; teeth small.
    - Trygonide, 21.
  - dd. Pectoral fins interrupted, the appendages on the snout ("cephalic fins") separate from the pectorals.

## SUPER-FAMILY PRISTOIDEA.

(The Pristoid Rays.)

## FAMILY XVII.—PRISTIDÆ.

(The Saw-fishes.)

Body elongate, depressed; pectoral fins moderate, the front margin quite free, not extending to the head; snout produced into a very long, thin, flat blade, which is armed with a series of strong tooth-like processes along each edge; teeth in jaws minute, obtuse; gill-openings moderate, inferior; spiracles wide, behind the eye; nostrils inferior; no tentacles; no nicitiating membrane; dorsal fins large, without spine, the first nearly opposite the ventrals. Caudal well developed, bent upwards; a fold along each side of tail. A single genus, with five or more species, inhabiting warm seas, sometimes ascending the rivers. A family of sharks, *Pristiophoridæ*, similarly armed with a "saw," occurs in the Pacific Ocean. (*Pristidæ* Günther, viii, 436–439.)

#### 34.—PRISTIS Latham, 1794.

### Saw-fishes.

(Latham, Trans. Linn. Soc. ii, p. 276; type Squalus pristis L. = Pristis antiquorum Latham.)

The characters of the genus are included above.  $(\pi\rho i\sigma\tau\eta\tau)$ , the ancient name of the saw-fish, from  $\pi\rho i\sigma\tau\eta\tau$ , a sawyer.)

#### 44. P. antiquorum Latham.—Saw-fish.

Anterior dorsal opposite ventrals; caudal fin without lower lobe; rostral teeth in 16 to 20 pairs, nearly equidistant, stout, provided with a cutting anterior edge; the size of the teeth subject to considerable variations; caudal fin without lower lobe; color grayish. Length 10 to 15 feet. Atlantic Ocean; common on both shores, especially southward; probably entering rivers.

(Squalus pristis L. Syst. Naturæ: Pristis antiquorum Latham, Trans. Linn. Soc. 1794, ii, 297; Günther, viii, 438.)

## FAMILY XVIII—RHINOBATIDÆ

(The Long-nosed Rays.)

Shark-like rays. Trunk gradually passing into the long and strong tail, which is provided with two well-developed dorsal fins, a candal fin and a conspicuous dermal fold on each side; disk not broad, the rayed portion of the pectoral fins not being continued to the snout; no conspicuous spines, the skin being nearly smooth; no electric organs. Genera 3 to 5; species about 15; inhabiting warm seas. The form of the body is as much shark-like as is that of the shark *Squatina*. (*Rhinobatida* Günther, viii, 440–448.)

Rhinobatus, 35.

#### 35.—RHINOBATUS Bloch & Schneider, 1801.

(Schneider ed. Bloch, lehthy.: type Rhinobatus rhinobatus Bloch & Schneider=Rhinobatus granulatus Cuv.)

Body depressed, gradually passing into the tail. Cranial cartilage produced into a long rostral process, the space between the process and the pectoral fin being filled by membrane. Spiracles wide, behind the eye; nostrils oblique, wide; anterior valves not confluent. Teeth obtuse, with an indistinct transverse ridge. Dorsal fins without spine; both at a great distance behind the ventral fins. Caudal fin without lower lobe. ( $\rho e \eta$ , a shark, Squatina;  $\rho a \tau o \tau$ , a skate.)

 $<sup>^{</sup>st}$  First dorsal much behind the ventrals; anterior nasal valves not confluent.

### 45. R. productus Avres.

"The anterior nasal valve is dilated into a very narrow lateral fold, scarcely projecting beyond the nasal margin. The length of the nostril is slightly more than its distance from the lateral margin of the head and more than the distance between the inner angles of the nostrils, and much less than the width of the mouth, which is very slightly arched. Snout produced, the distance between the outer angles of the nostrils being  $\frac{3}{5}$  of that between the mouth and the end of the snout. A series of small, depressed, polished spines along the median ridge of the back; groups of small, polished tubercles on the orbital margin and on the shoulder. A broad groove between the rostral ridges, which are separated along their entire length. Snout lighter colored than the rest of the body."—(Streets.) Coast of California and southward.

(Ayres MSS.; Girard, Proc. Ac. Nat. Sci. Phila. 1854, 196; Streets, Bull. U. S. Nat. Mas. vii, 1877, 55: Rhinobatus leucorhynchus Günther, viii, 444.)

## SUPER-FAMILY TORPEDINOIDEA.

(The Torpedinoid Rays.)

## FAMILY XIX —TORPEDINIDÆ.

(The Numb-fishes.)

Rays with the trunk broad and smooth; the tail comparatively short and thick, with rayed caudal fin, and commonly two rayed dorsal fins the first of which is over or behind the ventrals; a longitudinal fold on each side of tail; anterior nasal valves confluent into a quadrangular lobe; an electric organ composed of hexagonal tubes between the pectoral fins and the head. Genera 6; species about 15; large rays, noted for their power of giving electric shocks; found in most seas. (*Torpedinidæ* Günther, viii, 448–455.)

\* Dorsal fins two: ventrals separate; spiracles well behind the eyes....Torpedo, 36.

#### 36.—TORPEDO Duméril, 1806.

Electric Rays.

(Duméril, Zool. Analyt. p. 102: type Raia torpedo L.)

Electric rays with the disk very broad, abruptly contracted at the tail; two dorsal fins: caudal fin well developed; ventral fins large, separate; spiracles large, placed behind the eyes; mouth small; teeth pointed; skin perfectly smooth. Large rays, chiefly inhabiting the Atlantic.

## 46. T. occidentalis Storer.—Cramp-fish; Torpedo; Numb-fish.

First dorsal more than twice as large as second, placed over the ventrals; spiracles not fringed, their edges smooth; color almost uniform black, with obscure darker spots; beneath white; length 2 to 5 feet; breadth \(^3\) of length, the disk very blunt or almost emarginate in front. Atlantic coast; not very common.

(Storer, Am. John, Sci. Arts. 45, p. 165; Storer, Fishes Mass. 247.)

#### 47. T. californica Avres.—California Cramp-fish.

Dark grayish brown above, thickly spotted with black; disk broad and rounded, forming more than half the entire length; teeth small, very sharp. Coast of California. (Ayres.)

(Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 70.)

## SUPER-FAMILY RAIOIDEA.

(The True Rays.)

## FAMILY XX.—RAHDÆ.

(The Skates.)

Rays with the disk broad, rhombie, more or less spinous or rough; tail stout, rather long, with a longitudinal fold on each side, the skin commonly rough with spines; usually two dorsal fins and sometimes a caudal fin present on the tail; pectoral fins extending to the snout; ventrals large; no serrated spine on the tail; no electric organs: oviparous, the eggs being laid in large leathery egg-cases, four-angled, with two long tubular "horns" at each end. Genera 4 or more; species 40, most of them belonging to the genus *Raia*. Skates of generally small size; found in all seas.

## 37.—RAIA Linnaus, 1758.

Rays.

(Artedi-Linnieus, Syst. Nat. : type Raia clarata L.)

This genus, as here understood, comprises all those *Raiida* which have the pectoral fins not continued around the snout, the ventrals deeply notched, and the caudal fin little developed or wanting: the tail is very distinct from the disk, and is provided with two rayed dorsal fins; the skin of the body is usually more or less spinous; the dentition differs in the two sexes, and the male is usually provided with a differentiated patch of spines on each pectoral. Species numerous.

Our knowledge of the American species has been in a state of great confusion until very lately, the first careful comparison of the species having been made by Mr. Garman in 1874. On his excellent paper\* the following account is based. (*Raia or Raja*, the Latin name of fishes of this genus.)

## 1.—Atlantic Species.

\* Outline of the disk anterior to the spiracles rounded, not forming an angle at the tip of the snout.

† Rows of teeth about 59.

### 48. R. erinacea Mitchill.—Common Skate; Little Skate; Tobacco-box.

Form rhomboid, with all the angles rounded; spines largest on the anterior extensions of the pectorals, where they are close-set, strong, laterally compressed and hooked backwards; smaller ones are scattered over the head, above the spiracles, above and in front of the eyes, on the back, the median line of which is comparatively smooth, without larger median series, except in the young. A triangular patch on the shoulder-girdle; inner posterior angles of the pectorals nearly smooth; in the males near the exterior angles of the pectorals are two rows of large erectile hooks, pointing backwards. Females with groups of small scales on each side of the vent; teeth small, the middle ones sharp in the males; all blunt in the females; jaws much curved; each side of tail with a dermal fold; caudal fins rough, not separate to the base. Color light brown, with small round spots of dark brown; females larger than the males. L. 1 to 2 feet (Garman.) The smallest and commonest of our skates; abundant on our coast, especially northward.

(Raia erinacea Mitchill, Am. Journ. Sei. Arts, xi, 290, 1825: Raia eglanteria Günther, viii. 462; Garman, l. c. 176.)

†† Rows of teeth  $\frac{90}{85}$  ( $\frac{80}{78}$  to  $\frac{110}{108}$ ).

#### 49. R. ocellata Mitchill.—Ocellated Ray: Big Skate.

General form and appearance of the preceding; the arrangement of spines similar, except that additional rows of spines are present down the back and along the sides of the tail; caudal fin not separate, rough with small spines; jaws curved. Color light brown, with rounded dark spots; a translucent space on each side of the snout; near the posterior angle of the pectoral there is usually (but not always) a large white occllus, with a dark spot in the centre and a darker border; two smaller similar spots often present (Garman). Size very much larger than the

<sup>\*</sup> On the Skates (Rajæ) of the Eastern Coasts of the United States: By S. W. Garman. < Proc. Bost. Soc. Nat. Hist. xvii, Nov. 4, 1874, pp. 170-181.

preceding species, reaching a length of nearly three feet. The eggcases are more than twice as large as those of the smaller species.

(Mitchill, Trans. Lit. & Phil. Soc. i, 477, 1815; Raia diaphanes, pt.; Storer, Fish. Mass. 240; Garman, l. c. 177.)

\*\*Outline of the disk anterior to the spiracles forming a more or less marked angle at the tip of the snout.

‡Angle at tip of snout short and obtuse; rows of teeth  $\frac{40}{48}$ ; body and tail with large bucklers.

## 50. R. radiata Donovan.—Starry Ray.

In addition to the spines on the pectorals, head, back, and tail common to the preceding species, this species is marked by the presence of large spinous plates or bucklers. These are large strong spines, with broad stellate or shield-like bases. They are arranged as follows: One or two in front of each eye; one on each side between the eye and the spiracle; a pair on the shoulder, the smaller in front; and fourteen or more forming a dorsal row, beginning just back of the head and extending to the caudal. An irregular row of spines on each side of the tail, separated from the membrane by a band of shagreen; males with two or more rows of claw-like spines on the pectorals. Teeth with a long sharp point, rising from the middle and hooking backwards in the male, bluntish in the female; females larger than the males and more spinous. (Garman). Size medium. L. 1½ to 2 feet. North Atlantic; found both in America and Europe.

(Raia radiata Donovan, Hist. Brit. Fish. v, pl. 114, 1820; Günther, viii, 460; Garman, l. c. 177: Raia americana DeKay, 260.)

th Angle at tip of snout acute, moderately produced; rows of teeth  $\frac{50}{48}$ .

#### 51. R. eglanteria Lacépède.—Brier Ray.

Prickles comparatively small and very sharp, most numerous on the anterior portion of the pectoral, over the head, on the snout, on the middle of the back, and on the tail between the rows of larger ones; enlarged spines present around the eyes and spiracles, on the middle of the snout, in a median row along the back, and in two rows along each side of the tail; these spines very sharp, larger and smaller ones alternating in the rows; a large spine in the middle of each shoulder; a spine between the caudal fins. Color brown, with bands, bars, lines, blotches, and spots of darker in the middle of the pectoral; a translu-

cent space on each side of the rostrum. (Garman.) L. about 2 feet. Atlantic coasts of the United States; not very common.

(Raia eglanteria Bosc, MSS; Lacépède, Hist. Nat. des Poiss. ii, 103: Raia desmarestia Le Sneur, Journ. Ac. Nat. Sci. iv. 100: Raia chantenay Le Sneur, l. c. 103; Garman, l. c. 179.)

# Angle at tip of snout much produced, blunt; rows of teeth 32

#### 52. R. Lavis Mitchill. - Barndoor Skate.

Angles of the disk more acute than in any of the others; muzzle much produced, somewhat shovel-shaped at tip. Spines of the body very few and small. Some present above the eyes and spiracles, on the snout, along the anterior border of the pectorals, and on the back; those on the back very small. A median dorsal row of larger hooked spines extending along the median line of the posterior portion of the back and the tail. Usually two lateral rows on the tail. Female rougher, as usual among rays. Color variable, brownish, with paler spots, which are usually ringed with darker. The largest of our Atlantic species, reaching a length of about four feet. Virginia northward; not uncommon.

(Mitchill, Amer. Monthly Mag. ii, 327, 1817; Storer, Hist. Fish. Mass. 1867, 242; Garman, l. c. 180.)

#### 53. R. granulata Gill.

"A remarkable species, with the back and ventral surface covered with minute sharp granular ossifications, obtained by Capt. Joseph W. Collins on Le Have Bank. A species of the same type as *R. lævis*, and having 30 to 31 teeth on each side; the back granulated and slate colored; the ventrals distinguished by reticulate markings, and the claspers slender and scarcely expanded." (Gill.)

(Gill MS.; Goode & Bean, Bull, Essex Inst. xi, 1879, 28.)

## 2.—Pacific Species.

#### 54. R. cooperi Girard,-Big Skate.

Disk broad, its widest part behind the middle. Snont long, regularly long-acuminate, but not very sharp at tip, the anterior outline of the pectoral not much undulated, and little concave. Interorbital space very broad, almost flat, slightly depressed in the middle. Supraocular ridge scarcely elevated. Eyes small, shorter than the spiracles. Spines on body small and few. Two or three small spines around the eye. One or two near the centre of the back. Otherwise none on median line of back, in front of base of ventrals, where a series of spines begins, feeble

anteriorly, but growing larger backward. Females (as in other species) with lateral series of spines on the tail. Upper surface mostly covered with minute prickles, which are largest on the median line of the back, on the tail, and the front of the pectorals. Disk smooth below, except anteriorly. Teeth about  $\frac{48}{38}$ , the jaws rather strongly arched. Disk one-fifth broader than long, its width twice the length of the tail. Snout  $3\frac{1}{2}$  in length of disk,  $2\frac{3}{4}$  interorbital width. Color brown, with a dark ring at base of pectorals. Upper surface everywhere with round pale spots. The largest of our skates, reaching a length of over six feet. The egg-case nearly a foot long. Abundant on the Pacific coast from Monterey to Sitka.

(Girard, U. S. Pac, R. R. Exp. Fish. 372; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 135.)

### 55. R. rhina Jor. & Gilb.

Disk broad, the outer pectoral angle sharp, farther forward than in R. cooperi. Anterior outline of pectoral somewhat undulated and exceedingly concave, so that the snout is very long, acuminate, and tapering to the extreme point. Interorbital space quite narrow, little con-Supraocular ridges slightly elevated. Eyes large, much longer than spiracles. Spines on body comparatively strong; five to seven above the eyes; two or three near the middle of the back; none on the median line of the back until opposite the posterior end of ventrals, where a series of rather sharp spines begins. Prickles on body above rather large, sharp, strongly stellate; those on the snout largest and most stellate. Skin above everywhere prickly in the female; the prickles small and sparse on the base and edges of the pectorals and on ventrals; larger on the median region of the disk. Male with bases of fins smooth, and the prickles generally fewer and smaller; anterior edge of pectoral with spines. Under side of disk almost everywhere prickly in the females, smooth posteriorly in the males. Mouth somewhat arched. Teeth \(\frac{46}{6}\). Color light brown, nearly plain, with a dark ring at base of pectorals, which grows obscure with age. Disk onetenth broader than long, its breadth twice the length of the tail. Snont nearly one-third the length of the disk, 33 times the interorbital width. L. 23 feet. Monterey to Puget's Sound; not rare.

(Jordan & Gilbert, Proc. U.S. Nat. Mus. 1880, -..)

#### 56. R. binoculata Girard.—Common Skate (of California).

Disk broad, its widest part well forward; outer angle of pectoral blunt; posterior edge convex; anterior margin of pectoral undulated, not

strongly concave; snout rather pointed and projecting at tip, but not very long, its acumination being confined to its anterior half. Interocular space narrow, deeply and uniformly concave. Eves large, longer than spiracles. Supraocular ridge prominent. Spines on body rather stronger than in related species. Four or five over the eve; five or six (rarely fewer) along the median line, in front of the middle of the back. A series of very small spines along the middle of the back, changing opposite the middle of the ventrals into a series of rather strong hooked spines. Tail with a strong lateral series in females only, as usual in the Prickles on the body small and few. A small band of sparse prickles near the median line of back on each side of the median series of spines. Shout and interorbital space prickly. No prickles on the shoulders or on the fins, except the anterior edge of the pectorals. Below smooth, except the snout and front of pectorals. Teeth  $\frac{40}{40}$ . Jaws somewhat curved. Color light brown, slightly mottled; a blackish ring at base of pectorals, which becomes faint in the adult. A small dusky spot at base of ventrals and on posterior edge of pectorals. Disk one tenth broader than long, its breadth twice the length of the tail. Snout one-fourth the length of the disk, three times the interorbital width. L. 2 feet. Coast of California, from Monterey to Cape Mendocino; abundant.

(Girard, Proc. Ac. Nat. Sci. Phila. 1854, 196: *Uraptera binoculata* Girard, U. S. Pac. R. R. Expl. Fishes, 373; Günther, viii, 464.)

#### Var. inermis Jordan & Gilbert (var. nov.).

Differs in the small number and feebleness of the spines and prickles, and in the presence of a band of small prickles (in the females) on the posteror part of the pectorals, parallel with the edge. Supraocular spines almost obsolete. Two or three minute prickles often present at the shoulder. A series of minute stellate prickles beginning near the middle of the back, becoming hooked spines on the tail. Lateral caudal spines scarcely differentiated. A band of small prickles on posterior part of the back. Males almost smooth. Santa Barbara, Cal.

#### 57. R. stellulata Jordan & Gilbert.

Disk much broader than long, anteriorly broadly arched; the snout very obtuse, but its tip slightly exserted and acutish; anterior margin of pectorals somewhat undulated and convex; posterior margin very convex. A row of stout supraocular spines; about six spines on the scapular region, and a median row of strong spines on the tail. Entire upper surface rough with strong stellate prickles; these largest on

head, middle of back, and on tail. Under side smooth except anteriorly. Teeth  $\frac{40}{35}$ . Color brown, everywhere strongly variegated with light and dark colors; a black spot at base of each pectoral, surrounded by a pale ring, and this by a black ring; numerous black spots of various sizes, some of them occllated, scattered over the body; head with black eross-bars.

Disk one-fifth broader than long; the length of tail more than half the width of disk; the snout  $4\frac{1}{2}$  in length of disk, and  $2\frac{1}{2}$  times the interorbital width; the snout is as long as in *binoculata*, but much wider, appearing blunt and short. L.  $2\frac{1}{2}$  feet. Bay of Monterey, California; locally abundant.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 133.)

## FAMILY XXI.—TRYGONIDÆ.

(The Sting Rays.)

Disk usually more or less broader than long; the pectoral fins uninterruptedly confluent in front, forming the tip of the snout; tail variously formed, usually whip-like, sometimes short and stout, sometimes bearing a single dorsal or caudal fin, but never with two dorsals. Usually one or more vertical folds of skin on the tail, rarely a lateral fold. Tail generally armed with a large, sharp, retrorsely serrate spine on its upper surface, toward the base (two or three spines occasionally present). Ventral fins not emarginate. Skin smooth or variously prickly or spinous, roughest on the adult. No differentiated spines on the pectorals in the males, the sexes being similar. Mouth rather small. Teeth small, paved, usually more or less pointed or tubercular. Nostrils near together; nasal valves forming a rectangular flap, which is joined to the upper jaw by a narrow fremum. Spiracles large, placed close behind the eyes. Skull not elevated, the eyes and spiracles superior. Ovoviviparous. Genera about 10; species 50. Found in most warm seas, some of them in the fresh waters of Central and South America. The large spine on the muscular tail is capable of inflicting a severe and even dangerous wound.

(Trygonida Giinther, viii, 471-488.)

<sup>\*\*</sup> Tail slender, without caudal fin.

<sup>\*</sup> In the key to the families of *Raiw*, on page 36, the character assigned to *Trygonidw*, "Tail very slender, whip-like, its fins, if any, small and near its base," does not apply to the genus *Urolophus*, and should be modified. All the "Pachyura" have two dorsals and a trace at least of a caudal fin. In the "Masticura" one or more of these fins are obsolete, and a serrated caudal spine is generally present.

#### 38.--UROLOPHUS Müller & Henle.

## Round Sting Rays.

(Müller & Henle, Plagiostomen, 1837, 173: type Urolophus aurantiacus Müller & Henle = Raia cruciata Lacépède.)

Disk oval or rhombic, the length and breadth not very unequal. Snout rounded or slightly prominent. Skin smooth or somewhat prickly. Tail rather short, little if any longer than the disk, muscular, provided with a distinct rayed caudal fin; no dorsal fin. Upper part of the tail with a strong serrated spine. Warm seas. Size small. (abpá, tail; kógaz, crest.)

\*Skin perfectly smooth.

#### 58. U. halleri Cooper.

Disk nearly round, a little broader than long, with the anterior margins straightish, meeting in a slight angle. Snout (from the eyes) longer than the width of the interorbital space. Tail somewhat shorter than the disk. Skin without spines or prickles. Color light brownish, with marblings and wavy lines of yellowish and dusky, sometimes with yellowish spots, occasionally with wide, obscure dusky streaks, which are crossed by similar transverse streaks. Belly yellowish tinged. Coast of California, from Point Concepcion southward; exceedingly abundant in sheltered bays. L. 12. The smallest of our sting rays. Closely related to the Australian *U. cruciatus*, if not identical with it.

(Cooper, Proc. Calif. Ac. Nat. Sci. iii, 95.)

#### 39.—PTEROPLATEA Müller & Henle.

(Müller & Henle, Plagiostomen, 1837, 168: type Raia altavela L.)

Disk much broader than long, its anterior margins meeting in a very obtuse angle, its outer angles more or less acute. Tail very short and slender, shorter than the disk, without fin, usually armed with a small serrated spine. Skin smooth or very nearly so. Size moderate or rather large. Warm seas. (πτερα, fins; πλατέα, broad; πτεροπλατεία, an ancient name of P. altavela.)

\*Spiracle without tentacle.

#### 59. P. maclura (Le Sueur) Müller & Heule.—Butterfly Ray.

Disk scarcely twice as broad as long, covered with perfectly smooth skin. Tail about one-third as long as the disk, with a very slight dermal fold above and below. Snout a little projecting, so that the anterior edge of each pectoral is somewhat concave. Color brownish olive, finely marbled with grayish, and finely speckled. Anterior edge of disk

with half spots of paler. Tail with four dark blotches above, forming half rings. (Caudal spine wanting in all the specimens examined.) Virginia to Brazil: not uncommon.

(Raia maclura Le Sueur, Journ, Ac. Nat. Sci. Phila. 1817, 41; Duméril, Hist. Nat. Poiss. i, 614; Günther, viii, 487.)

#### 60. P. marmorata Cooper.

Disk about twice as broad as long, covered with perfectly smooth skin. Tail 33 in length of disk, with a rather small cutaneous fold above and below, the lower fold the longer, the upper about as deep. Interorbital space a little shorter than the snout. Snout slightly prominent, but forming a very obtuse angle. Olive-brown, finely mottled everywhere with darker, the dark forming reticulations around pale roundish spots. Tail without dark rings. Caudal spine much smaller than in other sting rays; present in all specimens examined. Coast of California from Point Concepcion southward; common.

(Cooper, Proc. Cal. Ac. Nat. Sci. iii, 112.)

#### 40.-DASYATIS Rafinesque.

Sting Rays.

(Trygon Adanson.)

(Rafinesque, Caratteri di Alcuni Nuovi Gen. 1810, 16: type Dasyatis njus Rafinesque = Raia pastinaca Linnæus.)

Disk oval, flat, with rounded angles. Tail very long and slender, whip-like, without fin, but often with one or two vertical membranaceous folds. A strong serrated spine toward the base of the tail. Skin more or less spinous or prickly, rarely smooth. Teeth small, paved. A few papillæ usually present in the mouth behind the lower jaw. Sting rays of large size, abundant in warm seas. Many of the spinous species are nearly or quite smooth when young. ( $\partial u\sigma \dot{v}\tau$ , shaggy or rough;  $\dot{\rho} \dot{u}\tau \dot{v}\tau$ , a skate; hence properly Dasybatis.)

\* Upper caudal fold obsolete; lower well developed. (Hemitrygon Müller & Henle.)

# **61. D. centrurus** (Mitchill) Jordan & Gilbert.—Common Sting Ray; Clam Cracker; Stingarce.

Disk a little broader than long, its anterior angle obtuse. Tail relatively stout, about one-third longer than the disk. A well-developed fold below, but the upper fold reduced to a mere trace. Disk perfectly smooth in the young, with more or less of tubercles along the median line of the back and the scapular region in the adult. Buccal papillae 3. Width of mouth about half its distance from the tip of the snout.

Caudal spine 1½ times width of mouth. Spiracles very large. Color nearly uniform brownish. L. 8 feet. Cape Cod to Florida; common. (Perhaps includes more than one species.)

(Raia centrura Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 479: Pastinaca hastata Dekay, New York Fauna, Fishes, 373: Trygon hastata Günther, viii, 476.)

#### 62. D. savi (Le Sneur) Goode & Bean.

Disk rhomboidal, a little broader than long, the muzzle moderately prominent. Width of mouth contained about  $2\frac{1}{2}$  times in the length of the snout. Tail with two well-developed folds, the lower fold considerably the larger, both smaller than in *D. dipterurus*. Tail slender, prickly, nearly twice as long as the disk; its spine extremely long; its length  $2\frac{1}{2}$  times the width of the mouth. Skin smooth in the young, becoming roughish with age. Several rather strong recurved spines along the middle line of the back. Spiracles moderate. Buccal papillæ 5 (7). Color brownish. South Atlantic States to Brazil.

(Raja say Le Sneur, Journ. Ac. Nat. Sci. Phila. 1817, 42: Trygou sayi Duméril, Elasmobranch. 603: Trygou pastinaca part Günther, viii, 478.)

## 63. D. dipterurus Jordan & Gilbert.

Disk rhomboid, slightly broader than long, anterior margins nearly straight, meeting anteriorly in a very obtuse angle; posterior margins curved; lateral angles rounded; tail nearly half longer than the disk, with a conspicuous cutaneous fold below and a smaller but evident one above; jaws considerably arched; buccal papillæ 3; teeth  $\frac{24}{23}$ . Young perfectly smooth. Adult with a row of low but rather stout tubercles on the median line of the scapular region and two others on the humeral region. Tail with small prickles. Caudal spine long, its length nearly 3 times the width of the mouth. Color bluish brown, nearly plain. L. 6 feet or more. Bay of San Diego, California; abundant.

(Dasybatis dipterurus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 31.)

#### 64. D. tuberculatus (Lacép.) Goode & Bean.

Disk rhomboidal, a little broader than long; anterior borders scarcely coneave, the posterior almost straight; external angles rounded; muzzle pointed; tail below with a cutaneous fold, higher and longer than the upper fold, covered for its posterior two-thirds with small ossifications; tail nearly  $2\frac{1}{2}$  times length of disk. All the middle of the upper surface of the body, from the posterior region of the head to the base

<sup>\*\*</sup> Upper and lower caudal folds well developed. (Dasuatis.)

of the tail, covered by an armature composed of a very great number of small bony tubercles. Along the median line an irregular series of tubercles with the base enlarged, almost quadrilateral, the points directed backward: a tubercle on the shoulder girdle on each side of the median line. Five papille in the mouth. Jaws strongly arched. Very young, almost smooth. Uniform brown. (Duméril.) Florida to Brazil.

(Raia tuberculata Lacépède, Hist. Poiss, ii, 103: Trygon tuberculata Duméril, Elasmobranch, 605: Trygon tuberculata (Ginther, viii, 480.)

#### 65. D. SEDEREIS (Le Sueur) Goode & Bean.

Disk oval-rhomboidal, scarcely longer than broad, the anterior borders lightly concave, united by rounded angles to the posterior borders, which are longer and a little convex; snout projecting; tail twice as long as the body; upper part of the head rough with small spines; on the middle of the back a row of tubercles commencing behind the head and prolonged on the base of the tail; 5 buccal papille; two spines on each side of the shoulder girdle; tail rough, with two short, low entaneous folds; mouth strongly arched. Color uniform yellowish brown. (Duméril.) "Distinguished from D. centrurus by the shape of the disk, the shape of the caudal spine, and the wing-like membranes on the tail" (Goode in lit.). Perhaps identical with the preceding.

(Trygon sabina Le Sueur, Journ. Ac. Nat. Sci. Phila. IS24, iv, 109: Trygon sabina Duméril, Hist. Nat. Poiss. i, 607: Trygon tuberculata Giinther, viin, 480, part.)

## FAMILY XXII.—MYLIOBATIDÆ.

(The Eagle Rays.)

Disk broad; the pectoral fins not continued to the end of the snort but ceasing on the sides of the head and reappearing in front of the snout as one or two fleshy protuberances (cephalic fins), which are supported by fin rays. Tail very long and slender, whip-like, with a single dorsal fin near its root, behind which is usually a strong, retrorsely serrated spine. Nasal valves forming a rectangular flap, with the posterior margin free, attached by a fremum to the upper jaw. Skull less depressed than usual among rays, its surface raised so that the eyes and spiracles are lateral in position. Teeth hexangular, large, flat, tessellated, the middle ones usually broader than the others. Ovoviviparous. No differentiated spines on the pectorals in the males, the sexes being similar. Ventrals not emarginate. Genera 3; species about 20. Large

Bull. Nat. Mus. No. 16—4

sting rays; inhabiting warm seas. Similar in habits to the *Trygonide*. (Group *Myliobatina* Günther, viii, 488-495.)

#### \* Muzzle entire.

#### 41 .- AETOBATIS Müller & Henle.

## Bishop Rays.

(Blainville; Müller & Henle, Plagiostomen, 1837: type Raja narinari Euphrasen.)

General form of *Myliobatis*. Muzzle entire. Teeth flat, broad, forming a single series corresponding to the middle series in *Myliobatis*, there being no small lateral teeth. Upper dental lamina straight, lower curved, the latter projecting beyond the upper. Free border of the nasal valve deeply emarginate. Skin smooth. Tropical seas. ( $\alpha \hat{\epsilon} \tau \delta \tau$ , eagle;  $\beta \check{\alpha} \tau \acute{\epsilon} \tau$ , ray.

## 66. A. marimari (Euphrasen) Müller & Heule.

Disk twice as broad as long, its anterior borders a little convex, posterior coneave, outer angles pointed. Cephalic fin about one-third broader than long. Teeth of the lower jaw straight or more or less angularly bent. Tail 3 or 4 times length of disk. Brown, with small round pale spots. (Duméril.) Virginia to the Indian Ocean; not very common on our coast.

(Raia narinari Emphrasen, Vet. Ak. Nya. Handl. 1790, xi, 217: Raia flagellum Bloch, Schn. 361; Günther, viii, 492; Duméril Hist. Nat. Poiss. i, 642.)

#### 42.-MVIJOBATIS C. Duméril.

## Eagle Rays.

(Duméril in Cuvier Règne Animal, ii, ed. 1, 137, 1817: type Raia aquila Linnæus.)

Disk broad, the outer angles acute; cephalic fins forming a soft convex appendage in front of the snout; jaws about equal; median teeth very broad, much broader than long in the adult, proportionally narrower in the young; several series of narrower teeth on each side of the median series. Free edge of the nasal valve not deeply emarginate. Tail very long and slender, with a small dorsal fin and one or more serrated spines. Skin smooth or nearly so. Size large. In all warm seas. (μυλίας, a grinder; βἄτίς, ray.)

#### 67. M. freminvillei Le Sperr.

Disk broader than long, the breadth equal to the length of the tail. Skin entirely smooth. A blunt, whitish prominence over each eye. Muzzle prominent. Teeth of the main row 4 to 6 times broader than long; small teeth in three rows. Reddish brown. Tail nearly black. Cape Cod to Brazil; not uncommon.

(Le Sueur, Journ. Ac. Nat. Sci. Phila. iv, 111: Myliobatis bispinosus Duméril, Hist. Nat. Poiss. 637: Myliobatis acuta Storer, Hist. Fish. Mass. 245.)

## 68. M. californicus Gill.—California Sting Ray: Batfish.

Disk not quite twice as broad as long; the wings anteriorly convex, posteriorly somewhat concave. Cephalic fin very blunt, nearly 4 times as broad as long. Tail nearly twice as long as the disk. Ventral large, broader than long. Lateral teeth in 3 to 5 series on each side; median teeth only 3 to 4 times as broad as long, even in the adult. Skin wholly smooth. Color dusky brownish, the young somewhat variegated. San Francisco southward; very common on the Pacific coast.

(Rhinoptera vespertilio Girard, Boston Journ. Nat. Hist. 1857, 544: Holorhinus vespertilio Gill. Proc. Acad. Nat. Sci. Phila. 1862, 331 (not Myliobatis vespertilio Blecker); Gill, Ann. Lyc. Nat. Hist. N. Y. 1865, viii, 137.)

#### 43.-RHINOPTERA Kuhl.

#### Cow-nosed Rays.

(Kuld, Müller, Abhandlungen Ak. Wiss. Berl. 1836, 237: type Rhinoptera brasiliensis Müller = Myliobatis jussieni Cuvier.)

Disk broader than long, with the anterior angles more or less acute. Shout more or less emarginate on the median line. Cephalic fin emarginate and placed on a plane below the level of the pectorals, the shout thus appearing four-lobed. Free border of the hasal valve not emarginate. Teeth in 3 to 20 rows, the median teeth more or less enlarged, but often smaller than in *Myliobatis*. Tail long, whip-like, with a small dorsal fin and a serrated spine. Tropical seas. (βν, shout; πτερόν, fin.)

## 69. R. quadriloba (Le Sueur) Cuvier.

Disk one-third broader than long; anterior borders almost straight, posterior undulated; muzzle deeply emarginate. Teeth in seven rows, the median teeth four times as broad as long. Tail very slender, a little longer than the disk. Skin smooth or nearly so. Color brownish. Cape Cod to Florida; not rare. Attains a large size.

(Raia quadriloba Le Suenr, Journ. Ac. Nat. Sci. i, 44; Günther, viii, 494; Duméril, Hist. Nat. Poiss. i, 648.

## FAMILY XXIII.—CEPHALOPTERIDÆ.

(The Sea Devils.)

Rays of enormous size, with the disk broader than long and the pectoral fins not continued on the sides of the head, the anterior or cephalic portion developed as two long ear-like appendages. Mouth wide, terminal or inferior. Teeth very small, flat or tubercular, in many series, those of the upper jaw sometimes wanting. Eyes lateral. Nostrils widely separated, their valves united, forming a flap as wide as the cleft of the mouth. Tail long and slender, whip-like, with a single dorsal fin at its base, and with or without a serrated spine. Ventral fins not emarginate. Skin more or less rough. Males without differentiated spines on the pectorals, the sexes similar. Ovoviviparous. Genera 2; species about 7. Largest of all rays and among the largest of all fishes. Found in the tropical seas.

(Myliobatida, group B. Ceratopterina Günther, viii, 496-495.)

#### 44 .- MANTA Bancroft.

(Ceratoptera Müller & Henle.)

(Bancroft, Zoöl. Journal, 1828-'29, iv, 444: type Cephaloptera manta Bancroft = Raia birostris Walbann.)

Disk broader than long, its exterior angles acute, the posterior margins of the pectorals concave. Head truncate in front; the cephalic fins long, turned forward and inward. Month large, terminal. Teeth minute, present in lower jaw only. Tail whip-like, often (always?) without serrated spine. Skin rough, with small tubercles. Two species known. (Manta, blanket, "a name used at the pearl fisheries between Panama and Guayaquil to designate an enormous fish much dreaded by the divers, whom it is said to devour after enveloping them in its vast wings.")

### 70. M. birostris (Walbanm) Jordan & Gilbert.—Sea Devil; Devil Fish; Manta.

Disk not quite twice as broad as long. Tail about as long as the disk. Teeth in about 100 longitudinal series, which are separated by distinct interspaces. Skin of body and tail everywhere covered with small stellate tubercles, rendering the surface very rough. Brownish, the

margins of the disk darker. (*Duméril*.) Tropical waters of America; north to North Carolina and San Diego. Reaches a width of about 20 feet.

(\*Raia birostris Walbaum": Cephaloptera vampyrus Mitchill, Ann. Lyc. Nat. Hist. N. Y. 1823, 23: Diabolichthys elliotti Holmes, Proc. Elliott Soc. Nat. Hist. 1856, 39: Ceratoptera vampyrus Duméril, Hist. Nat. Poiss. i, 650: Ceratoptera vampyrus Günther, viii, 498.)

## SUBCLASS HOLOCEPHALI.

(The Chimaras.)

The characters of the single order.

## Order F.—HOLOCEPHALI.

(The Chimaras.)

Skeleton eartilaginous. Gill-cavity with four clefts within, but having one external opening only, which is covered by a fold of skin, within which is a rudimentary cartilaginous operculum. No spiracles. Month inferior. Jaws without separate teeth, but armed with bony plates. Intestines with a spiral valve. No air-bladder. Jaws and palate coalescent with the skull. Derivative radii sessile on the sides of the basal bones of the limbs, separated from the articulation. Pectoral fins normally developed, placed low. Ventral fins abdominal. Tail tapering. Skin smooth or nearly so; its muciferous system well developed. A single family.

(Holocephala Giinther, viii, 348-352; δλος, solid; κεφαλή, head.)

## FAMILY XXIV.—CHIMÆRIDÆ.

(The Chimaras.)

Body elongate, rather robust anteriorly, tapering posteriorly. Head compressed. Mouth inferior. Upper lip deeply notched. Nostrils confluent with the mouth, separated by a narrow isthmus. Jaws with the teeth confluent into four bony laminæ above and two below. No spiracles. Males with a peculiar cartilaginous hook, armed with prickles at the tip, and turned forward on the upper part of the snout. Pectoral fins free, placed low. Ventral fins abdominal, many-rayed, provided in the male with claspers. Dorsal fin usually divided; anteriorly with a very strong spine, which is grooved behind. Candal fin low, fold-like. Skin naked, rarely somewhat prickly. Lateral line present, usually with numerous branches anteriorly. Three free gills and two half gills,

one on each side. Isthmus moderate; gill-rakers small. Oviparous, the egg-cases long, elliptical, with silky filaments. Genera 2 (*Chimæra* and *Callorhynchus*); species about 5. Abounding in the seas of temperate and cold regions.

(Chimarida Günther, viii, 349-352.)

\*Snout soft, not terminating in a cutaneous flap; tail not bent upward.. Chimæra, 45.

#### 45.-CHINAERA Linnaus.

### Rat-fishes.

(Linnans, Mus. Regis, Ad. Frid. i, 53; Syst, Nat.: type Chimara monstrosa L.)

Head somewhat compressed, the snout bluntish, protruding, fleshy, not armed at tip with an appendage. Eyes very large, lateral. Teeth rather strong. Lips thickish, the lower with a frenum. Lateral line simple on the body, but forking anteriorly, forming several series of mucous tubes on the head. Male with a club-shaped, cartilaginous hook on the head, above the snout. This hook is curved forward and downward, and is armed at its tip with decurved spines. Its tip fits into a depression in front of the eyes. Gill-opening small. Pectorals moderate. Ventrals rather large, with large bifid or trifid claspers in the Male also with rough appendages at the base of the ventrals, protruding from a sheath of skin. First dorsal triangular, preceded by a strong spine which is grooved behind and serrated on its edges. Seeond dorsal and caudal fins low, often more or less notched. Tail extending in the line of the axis of the body, sometimes produced in a filament. Skin smooth. Fishes of singular appearance; mostly of the northern seas; not valued for food. (Χίμαιρα, Chimæra, a fabulous monster, with the head of a lion, body of a goat, and tail of a serpent.)

## a. Claspers in the male trifid. (Chimara.)

#### 71. C. plumbea Gill.

"A Chimara with the snout acutely produced; the ante-orbital flexure of the suborbital line extending little above the level of the inferior margin of the orbit; the dorsals close together; the dorsal spine with its anterior surface rounded; the ventrals triangular and pointed; the pectorals extending to the outer axil of the ventrals; and the color uniformly plumbeous." (Gill.) Atlantic coast from Cape Cod northward; in deep water.

(Gill, Proc. Philos. Soc. Washington, Dec. 22, 1877.)

aa. Claspers in the male bifid. (Hydrolagus\* Gill.)

<sup>\*</sup>Gill, Proc. Ac. Nat. Sci. Phila. 1862, 331: type Chimara collici. (ὑδωρ, water; λαγὸς, hare; from the form of the lips and teeth.)

### 72. C. colligei Bennett.—Ral-fish; Elephant-fish.

Body anteriorly stoutish, tapering into a slender tail, which is not produced in a filament. Pectorals about as long as head. Dorsal spine <sup>3</sup>/<sub>4</sub> the length of the head. Second dorsal low, highest in front, then very low, then higher, ending abruptly just before the beginning of the upper caudal fold. A small fold between first and second dorsal, free from both. Lower candal fold higher than upper, neither quite reaching the tip of the tail. No distinct anal fin. Color grayish, with numerous round white spots. Both dorsals edged with blackish. L. 2 feet. Pacific coast, from Monterey northward; very abundant.

(Bennett, Beechey's Voy. Zoöl. 71; Duméril, Elasmobranches, 689; Günther, viii, 350.)



## ADDENDA TO MARSIPOBRANCHII, ELAS-MOBRANCHII, ETC.

Note.—The first forty-one pages of the present work were printed in the spring of 1879, more than a year before work was resumed on the remaining part. Meanwhile numerous additions have been made to our list of sharks, which may be noticed here. A few errors may also be corrected.

Page 2, last line: For "Epigonopterus" read Epigoniehthys".

Page 3: For "B. earibæum" read "1. B. lanccolatum (Pallas) Gray". The Lancelet occurs also on the coast of Southern California.

Page 6: For "3. B. stouti Lockington" read:

## "3. B. dombeyi Müller.

"Plum-color or purplish, the edge of the lower fold only pale. Gills usually 12-11. Teeth 10 in each series. L. 20 inches. Shout 20 times in total length; head to first gill-opening  $4\frac{1}{5}$ ; branchial region 8; tail 8. Coast of California and southward; not rare. Burrowing from the gill-openings or the eyes into the flesh of large fishes, and soon leaving nothing except the head, skin, and skeleton.

"(Gastrobranche dombey Lac.; Müller, Mém. de l'Acad. Berlin, 1834, 80: Bdellostoma polytrema Grd.; etc.)"

Page 7: Lampetra (Entosphenus)\* tridentatus and L. plumbea are perhaps generically distinct, as the lingual teeth in the former are pectinate and in the latter obscurely tricuspidate. The diagnosis of Lampetra should be modified accordingly.

Page 8: "5. L. epihexodon" and "6. L. astori" should be suppressed, as they are probably identical with E. tridentatus.

Page 13: For "GINGLYMOSTOMATIDÆ" read "SCYLLHDÆ"; and under "i" for "ventrals" read "pectoral".

Page 15: Somniosus microcephalus is abundant on the Pacific coast from Cape Flattery northward. Twelfth line from the bottom: For "pectorals" read "ventrals".

Page 17: Instead of "Family VI.—Ginglymostomatida", etc., read:

<sup>\*</sup> Gill, MSS. Proc. Ac. Nat. Sci. Phila. 1862, 33, not characterized. ( $\epsilon_{p770}$ , within;  $\sigma\phi_{qp}$ , wedge; from the small maxillary tooth wedged in between the others.)

## "FAMILY VI.—SCYLLIIDÆ.

## "(The Roussettes.)

"Sharks with two dorsal fins, without spines, the first above or behind the ventrals. Anal fin present, usually below the second dorsal; caudal fin rather long, with or without a basal lobe. Tail not keeled. Spiracles present. No nictitating membrane. Last gill-opening above the root of the pectorals. Mouth usually broad, with small teeth, several series being in function. Teeth with a median cusp, and 1 to 4 small ones on each side. Usually a distinct furrow at the angle of the mouth. Nostrils near the mouth, sometimes confluent with it, sometimes provided with cirri. Oviparous. Coloration often variegated. The egg cases quadrate, with prehensile tubes at the angles.\* Sharks of the warm seas. Genera 8 or 9; species about 30.

"(Scylliida, Günther, viii, 400-414.)

- "\* Nostrils confluent with the mouth; caudal bent upwards, with basal lobe. (Gin-glymostomatina.)
- "a. Teeth in both jaws in many series, each with a strong median cusp, and one or two smaller cusps on each side; nasal cirri present.....GINGLYMOSTOMA, 13. "\*\* Nostrils not confluent with the mouth; candal not bent upwards. (Scylling.)
  - "b. Nostrils separated by an isthmus; no nasal cirri; tail not serrated.

SCYLLIUM, 13 (b).

## "13.—GINGLYMOSTOMA Müller & Henle." (See page 18.)

### "13 (b).—SCYLLIUM Cuvier.

"(Cuvier Règne Animal ed. 2, 1829: type Scyllium catulus Cuv. = Squalus stellaris Gmel.)

"Body rather stout. Head more or less short and broad, the snout low and blunt. Mouth rather large. Teeth small, sharp, tricuspid, in about four rows. Labial fold small or obsolete. Nostrils not confluent with the mouth, separated by a broad isthmus from each other, each with a free flap and no cirrus. Spiracle moderate, close behind the eye. First dorsal beginning over ventrals; second dorsal nearly over anal. Tail slender, not much bent upwards. Spotted. Warmer parts of the Atlantic and Pacific. As here understood, distinguished from Seylliorhinus Blainville, 1816 (S. caniculus L.), by the separate nasal valves. (σεὐλλων, a shark from σεύλλω, to tear.)

"\* Head very broad and depressed, broader than long. (Cophaloscyllium† Gill.)

<sup>\*</sup> In Heterodontida the egg-cases are without tentacles and spirally twisted. Except the Seylliida and Heterodontida, our sharks are all ovoviviparous.

<sup>†</sup> Gill, Ann. Lye. Nat. Hist. N. Y. 1861, 412: type Scyllium laticeps Duméril. (κεφαλη, head; σκύλλιον, Scyllium.)

#### "18 (b). S. ventriosum Garman.—Swell Shark.

"Grayish, tinged below with yellowish. Back with black cross-bars, upper parts with large round black spots; sides also with small whitish spots. Head very broad and depressed, broader than long, and not half as deep as broad. Snout very blunt, projecting little beyond the mouth. Mouth very broad, little arched, with only a trace of labial fold. Teeth similar in both jaws, small, tricuspid, in about four series,  $\frac{6.0}{5.4}$  in number. First dorsal beginning over middle of ventrals; second dorsal beginning behind front of anal and ending before end of anal. When caught, this shark inflates its stomach with air, like the *Tetrodontidæ*, till its diameter is one-third its whole length. It will then float belly upward on the water. L.  $2\frac{1}{2}$  feet. Monterey to Chili; very abundant in Santa Barbara Channel. A small, voracious shark, often taken in lobsterpots.

"(Garman, Bull. Mus. Comp. Zoöl. vi, 167: 1880, ?? Scyllium laticeps Aug. Duméril, Rev. et Mag. Zool. 1853, 84, pl. 3, fig. 2: Cephaloscyllium laticeps Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 40.)"

Page 19, in key, after "a", add:

## After "f" add:

## After "ff" add:

"fff. Teeth in upper jaw serrate at base, in Iower jaw entire....Hypoprion, 19 (b)."

Page 20: Erase "20. Mustelus ealifornieus", which is doubtless identical with Mustelus hinnulus, and add:

### "14 (b).-RIHNOTRIACIS Gill.

"(Pleuraeromylon Gill, 1864.)

"(Gill, Proc. Ac. Nat. Sci. Phila, 1862, 486; type Rhinotriacis henlei Gill.)

"Characters of the genus Mustelus, except that each embryo is attached to the uterus by a placenta. The teeth are sharper, some of them being pointed, and with one or more short basal cusps. Warm seas.  $(\hat{\rho}\nu, \text{snout}; \tau \rho \epsilon \bar{\iota} az \iota z, \text{Triacis.})$ 

## "20.-R. henlei Gill."

(See text, "22. T. henlei"; eoast of California; not uncommon.)

"20 (b). R. lævis (Risso) Jordan & Gilbert.

"A small shark resembling Mustelus himulus and R. henlei, but differing from the former in the dentition and in the attachment of the embryo to the uterus by a placenta, and from the latter in the blunter teeth. Only those in the posterior part of the upper jaw have a basal cusp, and these usually but one only. This species is found on the coast of Europe and Africa, and is accredited to our Atlantic fauna by Günther (viii, 386).

"(Mustelus læris Risso, Europe Méridionale, iii. 127: Mustelus læris Günther, viii, 385: Pleuracromylon læris Gill, Proc. Ac. Nat. Sci. Phila. 1864, 148; not of Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 52, = Rhinotriacis henlei.)"

Page 21: Galeorrhinus galeus, the "Oil Shark", is very abundant on the coast of California, especially southward. Its teeth are coarsely serrated on the outer margin near the base only. Galeocerdo tigrinus also ranges northward to San Diego on the Pacific coast.

Pages 22: Carcharinus glaucus occurs on the coast of California.

Page 22: Instead of "\*\*" insert:

### "18 (b).-EULAMIA Gill.

"(Gill, Ann. Lyc. Nat. Hist. N. Y. 1861, 401: type Carcharias lamia Risso.)

"Body rather robust, the head broad and depressed; mouth inferior, with the teeth in both jaws strongly serrated in the adult; less so or entire in the young; those in the upper jaw broad, those below narrow, straight, and nearly erect. No spiracles. First dorsal large, placed not far behind pectorals. Pectorals falcate. Second dorsal small. Embryos attached by placentæ to the uterus as in Scoliodon and Rhinotriacis.\* (In Carcharinus placentæ are not developed, according to Auguste Duméril, Hist. Nat. des Poiss. i, 244.) Species numerous. (ευ, well; λαμια, Lamia or Lamua, a fabulous monster, from λαιμός, devouring hunger.)"

Page 22: The species of "Eulamia" should stand as:

"26. E. obscura (Le S.) Gill", "27. E. milberti (M. & H.) Gill", and "27 (b). E. lamia (Risso) Gill".

Page 23: Under "E. lamia" add:

"27 (b). E. Rannier (Risso) Gill.—Bay Shark.

"Body robust, the back elevated. Head broad and flat; the snout

<sup>\*</sup> So far as known to us, the embryos in all our ovoviviparous sharks except Eulamia, Scoliodon, and Rhinotriacis are without placenta.

long, but wide and rounded, its length from mouth greater than distance between nostrils, which are nearer snout than angle of the mouth. Eye moderate. Teeth  $\frac{3.0}{3.0}$ , their form as in *E. lamia*, the upper regularly triangular, without notch, narrow in the young, the lower narrowly triangular, erect, on a broad base, all the teeth distinctly and evenly serrated. First dorsal beginning at a distance a little less than its own base behind the pectorals, and ending at a point a little more than its own base behind the ventrals. Height of first dorsal two-thirds the depth of the body; pectoral reaching past first dorsal. Second dorsal very small, not one-sixth the height of the first, smaller than anal and nearly opposite it. Tail  $3\frac{1}{2}$  in length. Color plain light gray. Warm seas north to San Diego Bay.

"Our specimens differ from descriptions of *E. lamia* in not having the first dorsal higher than the body, and inserted close behind the root of the pectorals. In *E. obscura* and *E. milberti* the upper teeth are deeply notched on the outer margin".

Page 24: After "Isogomphodon limbatus" add:

### "19 (b).—IIYPOPRION Müller & Henle.

"(Hypoprionodon Gill.)

"(Müller & Henle, Plagiostomen, 1837, 34: type Carcharias macloti Müller & Henle.)

"Characters essentially as in *Eulamia*, but with the *lower teeth entire*, the upper teeth coarsely serrated at base only, on one or both sides; lower teeth erect. ( $\delta\pi\delta$ , below;  $\pi\rho i\omega$ , saw; the upper teeth being serrated at base.)

### "28. II. brevirostris Poev.

"Snout obtuse; teeth of the upper jaw with the base serrate on both sides; pectoral fins moderate. Bluish, fins without black spots. (*Pocy.*) West Indies; occasional on our Gulf coast.

"(Poey, Synopsis Pise. Cubensium, 1868, 451: Carcharias brevirostris Güuther, viii, 362.)"

Pages 26, 29, 30, 31: Sphyrna zygæna, Lamna cornubica, Carcharodon rondeleti, Cetorrhinus maximus, and a species of Isurus (probably I. oxyrrhynchus) occur on the coast of California.

Page 34: For the key to genera substitute:

### "31 (b).—HEXANCHUS\* Rafinesque.

"(Notidanus Cuvier.)

- "(Rafinesque, Caratteri di Alenni Nuovi Generi, etc. 1810, 14: type Squalus griscus Linnaeus.)
- "Branchial apertures six on each side; otherwise essentially as in Heptranchias. Two species known. ( $\tilde{\epsilon}\tilde{\epsilon}$ , six;  $a\gamma z a\tau$ , bend or sinus; for gillopening.)
- "41 (b). II. corinus Jordan & Gilbert.—Shorel-nosed Shark.

"Color almost black, unspotted; a grayish lateral streak. Head large, broad, depressed and blunt. No median tooth in upper jaw. About six pointed teeth in front of upper jaw, all entire and without basal cusps. Next three teeth with entire edges and a single cusp on the onter margin. Remaining teeth of upper jaw serrate on the inner margin, and with two or more basal cusps on the outer. Median cusp of lower jaw very small. Other teeth with six cusps, the first the largest, the others regularly smaller, the inner edge in the adults serrated. Tail long, twice as long as head, a little less than one-third the total length. Scales on upper edge of tail enlarged. Monterey to Puget's Sound.

"(Jordan & Gilbert, Proc. U.S. Nat. Mus. 1880, 352.)

## "32. HEPTRANCHIAS Rafinesque.

"(Notorhynchus Ayres.)

"(Rafinesque, Caratteri di Aleuni Nuovi Generi, etc. 1810, 13: type Squalus cinercus Gmelin.)

"Gill-openings seren on each side. Three species known. ( $\xi \pi \tau \dot{a}$ , seven;  $\beta \rho \dot{a} \gamma \chi \iota a$ , gills. The change of this name to "Heptanchus" is hardly justifiable.)

#### "42. II. maculatus (Ayres) Girard.

"Sandy gray, with some round black spots, larger than the pupil, rather sparsely placed. Head rather depressed; the snort broad, rounded; the nostrils near its tip; spiracles large, nearer the gill-opening than the eye; a long furrow at the angle of the month. No median

<sup>\*</sup>The necessities of nomenclature often require the substitution for the name of the typical genus of a family of some less familiar but earlier name, as Hexanchus for Notidanus, Carcharias for Odontaspis, Dasybatus for Trygou, etc. It is probably unnecessary to change well-known family names to accord with these changes. Among our sharks it is perhaps better to retain the old family names Odontaspidida, Notidanida, Cestraciontida, instead of Carchariida, Hexanchida, and Heterodontida, as given in the text. The name Carchariida, used by various authors for the Galcorrhinida, is ineligible, because the name Carcharias rightfully belongs to a genus of another family.

tooth in upper jaw. Two small teeth near together in front, simple and pointed; two a little larger, behind and ontside of these, then two others directly behind the first pair. Next, on each side, a tooth much larger, pointed, with a conspicuous cusp on the outer side at base, and one or more denticulations beside. The other teeth are larger, similar, but more serrated and more oblique, approaching the lower teeth in form. The median tooth in the lower jaw is broad, with a small median cusp and two or three larger lateral cusps on each side. The other teeth, 6 on each side, are much broader than high, with about 4–6 sharp outward-directed cusps. The first cusp is longest and bears a small tooth near its base. These teeth are quite similar and increase slightly in size outwards. Tail long,  $2\frac{3}{4}$  in total length, the caudal fin mostly below it. Anal small, just behind the small dorsal. Coast of California and northward; common.

"(Notorhynchus maculatus Ayres, Proc. Cal. Acad. Nat. Sci. i, 72; not Notidanus indicus Cuvier, etc.)"

Page 36, fourth line: After "small" add "or wanting".

Under "\*", after "thick", instead of "usually with rayed", etc., read "with two dorsal fins".

Under "\*\*", instead of the text, read: "Tail with one dorsal fin, or none."

Page 38: After "Rhinobatus productus" add:

"§ Anterior nasal valve prolonged to the internal angle of the nostrils; snout not clongate. (Syrrhina\* Müller & Henle.)

## "45 (b). R. exasperatus Jordan & Gilbert.

"Disk rhombic, about as broad as long. The snout prominent, but bluntish at tip, anterior margin of pectorals forming less than a right angle. Eyes rather large. Rostral ridges separate their whole length. Tail stout, depressed, with a narrow lateral fold, upper surface entirely covered with stout, close-set, stellated prickles of different sizes, largest on the bases of the pectorals and smallest on the outer edges of the fins, those on the tip of snout and anterior edge of the pectorals not enlarged. Stout, bluntish, slightly recurved spines present as follows: One at the upper anterior angle of the eye and two behind it; one large one at the middle of the shoulders, in front of which are two others; two series on the shoulders outside the median line, the inner of two, the outer of two to four; a series of about a dozen on the median line of the back and tail; no lateral series on the tail. Sexes similar. Under side covered

<sup>\*</sup> Müller & Henle, Plagiostomen, 113: type Syrrhina columnæ M. & II.  $(\sigma \hat{\nu} \nu,$  together;  $\hat{\rho}(\nu,$  snout.)

with shagreen, made of triangular depressible asperities. Region from the nostrils to the shoulder girdle smooth, except the lower lip. A few other small naked areas below. Upper lip developed. Teeth  $\frac{32}{26}$ . Color brown, mottled and barred with blackish; a black blotch on hinder part of pectorals below. Tail rather shorter than disk. First dorsal not far behind ventrals. Shout one-fifth the length of disk, twice the interorbital space. San Diego Bay; abundant. Only young specimens known, but it is probably ovoviviparous and therefore not a *Raioid*.

"(Platyrhina exasperata Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 32: Zapteryx exasperatus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 53: Trygonorhina exasperata Garman, Bull. Mus. Comp. Zoöl. 1880, 170.)

## "45 (e). R. triscriatus Jordan & Gilbert.

"Disk broad, ovate, broader than long. The snout very bluntly rounded, not projecting, the angle formed by the pectorals anteriorly very obtuse; anterior outline of the pectorals slightly convex, not undulated. Tail very stout, much longer than the disk, its edges with a broad fold, broader than in R. exasperatus. Pectoral fins extending almost to the tip of the snout; rostral ridges wide apart, converging, inclosing a triangular area. Eyes small, wide apart, the broad spiracles close behind them. Caudal fin well developed above and below. Dorsals similar, their posterior free margins very convex. broad, its width nearly equal to its distance from tip of snout, a deep crease passing around it behind, in front of which the lower lip has three folds of skin; upper lip not developed, a fold of skin passing from the angle of the mouth on either side to the inner angle of the nostrils, thence straight across, inclosing a depressed trapezoidal / \--\shaped area, bound below by the curved outline of the upper jaw. In this are three cross-folds of skin. Teeth  $\frac{6.0}{5.6}$ . Gill-openings narrow. where, above and below, covered with fine shagreen, the prickles coarser on the anterior outer margin of the pectorals (3), where are two or three rows of retrorse spines. Four strong spines on the tip of the snout, forming a rhombic figure; four or five spines around each eye. A long series of very strong spines along the median line of the back and tail, and a series of similar ones on each side of the tail; a single strong spine on the outer edge of the shoulder-girdle and two between this and the median series. Color light olive brown, without distinct markings. L. 2 feet. Breadth of disk one-tenth more than its length; tail usually half longer than disk; snout two-ninths of length of disk, not half longer than width of interorbital area. Coast of California from Point Concepcion southward; abundant. In spite of its resemblance to the Raioid

genus Platyrrhina, this species proves to be viviparous. It is, therefore, referred to the Rhinobatidae, the oviparity of Raiidae being the only character distinguishing the two families.

" Platurhina triscriata Jordan & Gilbett, Proc. U. S. Nat. Mus. 1880, 36.)

### "45 (d). R. leminimosas Garman.

"Gravish, with small paler spots, uniform below. Outline similar to that of R. moductus. Shout long and narrow, its ridges close together throughout. Eves large, twice as large as spiracles. Interorbital space narrow, concave, as wide as nostrils or the interspace between them. Distance between outer angles of nostrils more than half the shout. Mouth straight, its width not quite twice the interorbital space. Dorsal and preocular spines very small; 5 larger spines on tip of snont. Supraocular and scapular spines obsolete. L. 22 inches. Width 3 in length: tail about 2; snout to the mouth 53. Coast of Florida. (Garman.)

"(Garman, Bull, Mus. Comp. Zoöl, 1880, 168.)"

Page 47, genus Dasyatis: The following synopsis of the American species of the genus Dasyatis, or better Dasibatis, has been prepared at our request by Mr. Samuel Garman, of the Museum of Comparative Zoölogy. It was received too late for insertion in the text. We, therefore, place it here in the form in which it was written by its author:

## THE AMERICAN SPECIES OF THE GENUS DASIBATIS.\*

#### BY SAMUEL GARMAN.

Tail more than twice the length of the disk,
keeled on the top;
snout acute, pointed; tail very long, roundtuberculata
snout not prominent; tail compressedlonga
round on the top, compressed, with lateral series of large tubereles;
snout not prominent; anterior margins slightly sinnons
snout prominent, with a series of long, narrow, depressed tubercles on the
middle of the backlata
Tail less than twice and more than one and a half times the length of the disk,
with two expansions;
disk subeircular; snout prominentsabina
disk quadrangular; snout not prominentsayi
keeled on the top, with an expansion below; with three series of tubercles on the
shoulders
Tail less than one and a half times the length of the disk,
with two expansions;
month with five papillæbrevis
mouth with three papilladipterura
*Dasybatus Walbaum, Kleinii Jehthyol, Enod, sive Index rerum, etc. 1793, 35; type

Raja pastinaca L. This use of the name has precedence of "Dasyatis" Raf.

#### DASIBATIS TUBERCULATA.

Raja tuberculata Lacép. ii, p. 106, pl. 4, fig. 1.
Raja tuberculata Shaw, Gen. Zoöl, v. pt. 2, p. 290, pl. 127.
Trygon gymnura Müll. Erman's Reise um die Erde, p. 25, Taf. 13.
Trygon ostrosticta Müll. l. c. p. 25, Taf. 14.
Trygon tuberculata Duméril, Elasmobr. p. 605.
Trygon tuberculata Günther, Cat. viii, p. 480.

Disk quadrangular, a little wider than long. Snout produced, sharp pointed. Anterior and posterior margins nearly straight, the anterior curved near the outer angle to meet the posterior, and the latter curved near the hinder angle to meet the inner. Tail nearly three times the length of the disk, with a slight ridge above and a narrow cutaneous expansion below, roughened with small spines similar to those on the head, bearing a long serrated spine. A row of elongated tubercles on the dorsum and anterior portion of tail and one or more smaller ones on each shoulder. The posterior tubercles of the median row are so much clongated as to resemble the spine. Month much undulated, with three papilla. Teeth small, unequal. Color yellowish to olivaceous brown, darkening with age. The young are without scales or tubercles. As the animal grows older and the tubercles appear a few scattered asperities appear on the head; still later these increase in number and size to such an extent as to cover the head and dorsum with a heavy coat of mail made up of the closely-set flattened scales. The tubercles of the back cease growing as the scales enlarge, and ultimately there is little distinction between them. Usually the tubercle on the middle of the pectoral arch is larger; those on the tail continue to increase in size with age. A young female measures in length of body 9.9, length of tail 28.2, and width of disk 11.6 inches.

Cannavierias, Surinam, Para, Bahia, and Rio Janeiro.

#### DASIBATIS LONGA.

(Garman, 1880, Bull. Mus. Comp. Zoöl. vi, p. 170.)

Disk quadrangular, about one-sixth wider than long. Margins nearly straight, anterior meeting in a blunt angle on the end of the snout. Outer angles rounded, posterior blunt. Ventrals rounded. Tail more than twice as long as the body, roughened with small asperities, depressed anteriorly, compressed behind the spine, keeled above the compressed portion, with a long, narrow entaneous expansion on the lower side. Month curved with five papilla. A row of small tubercles behind the head on the shoulder girdle. It is likely that larger specimens are provided with tubercles on back and tail.

Distinguished from *D. lata* by the shape of the snout and disk and the keel on the tail, and from *D. centrura* by the straight margins of the pectorals and the keel.

One specimen secured at Acapulco, Mexico, by Prof. Alexander Agassiz. One light-colored, reddish-brown specimen from Panama by the Hassler Expedition.

Length of body 11.5, tail 28, and width of pectorals 13.8 inches. Length of body of second specimen, 9.3, tail 24.5, and width of pectorals 11.2 inches.

### Dasibatis centrura.

Raja centrura Mitch. Trans. Lit. & Phil. Soc. N. Y. i, p. 479. Tragon centrura Linsley, Silliman's Am. Jour. Sci. & Arts, 47, 1844, p. 166. Tragon centrura Gill (name only), Cat. Fish. E. Coast N. Amer. p. 34.

Disk quadrangular, about one-fourth wider than long. Anterior margins sinuous, concave opposite the eyes, convex toward the slightly protuberant snout and rounded outer angles; posterior straighter, a very little convex; inner convex. Hinder angles blunt. Ventrals truncate, with rounded angles. Tail more than twice as long as the body, much compressed, rounded above, with keel and entaneous expansion below, with one or more strong serrated spines at the termination of the anterior fifth of its length, rough on all sides with spines or tubercles. Till half grown the young are naked; as they approach maturity broad stellate-based, conical-pointed, irregularly-placed bucklers appear on the middle of the hinder part of the back and on the top and sides of the tail. Very large examples have the central portion of the back closely mailed with small flattened tubercles. The bucklers bear more resemblance to those of the Rajae, radiata and clavata than to the tubercles of pastinaca, hastata, or tuberculata. Mouth arched forward, with five papilla. Teeth in quincunx, blunt, smooth. Color of back and tail olive brown; light to white below. From pastinaca, which this species resembles in shape. it is distinguished by the tubercles, by the length and compression of the tail, and absence of all trace of keel or expansion on its upper side. A young specimen measures from snort to tail 13.8, length of tail 30.5, and width of pectorals 17.5 inches. The largest specimen in the collection has a total length of 10 feet 3 inches. Common south of Cape Cod. Occasionally found northward.

#### Dasibatis Lata.

(Garman, 1880, Bull. Mus. Comp. Zoöl, vi, p. 170.)

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Disk quadrangular, one-fourth wider than long. Anterior margins nearly straight, forming a very blunt angle at the snort, rounded near

the outer extremities; posterior convex; inner straight a portion of their Ventrals truncate, rounded. Snout produced, forming a rounded prominence in front of the margins of the disk. Length from the forehead less than the width of the head. A line joining the wider portions of the disk passes nearer to the head than to the shoulders. Tail more than twice as long as the body, without a trace of keel above: a long narrow expansion below has its origin opposite that of the spine, and terminates in a keel which continues to the extremity, roughened with small tubercles, with an irregular series of broad-based conical tubercles on each side. A pair of large, compressed, erect tubercles stands immediately in front of the caudal spine, and a similar one is placed over the middle of the pelvic arch. These suggest a continuous series in larger specimens. Three larger elongated tubercles, with points directed backward, similar to those of D. hastata, occupy the middle of the shoulder girdle. Mouth curved, six (5-6?) papillæ at the bottom behind the teeth; two of these are in the middle in front, where usually there is but one. Color light olive, probably greenish in life, white below. Distinguished from D. centrura by the prominent snont, the shape of the tubercles in the middle of the back, and the narrowness of the posterior portion of the disk. Length of body 16, tail 35.3, and width of pectorals 20.5 inches. Sent from the Sandwich Islands by Andrew Garrett.

#### DASIBATIS SABINA.

Trygon sabina Lesneur, Jour. Acad. Nat. Sci. Phil. iv, p. 109. Trygon sabina Miill. et Henle, Plagiostomen, p. 163. Trygon sabina Dumérit, Elasmobranch, p. 607.

Disk subcircular. Snout produced, blunt. Anterior margins of the pectorals concave near the snout, becoming convex toward the broadly rounded outer extremities; hinder and inner margins convex. Upper jaw with a deep indentation, receiving a corresponding prominence on the lower. Teeth at the sides of this indentation much larger, resembling the molars of Heterodontus. Mouth with five papillæ. Tail less than twice as long as the disk, tapering to a fine point, rough with small prickles similar to those scattered over the head and back, a cutaneous expansion above, and a broader, longer one below. These end nearly opposite each other, the lower extends forward under the spine. With a median row of tubercles on the dorsum and one or a pair on each shoulder. Distinguished from tuberculata by the shape of the snout, the rounded pectorals, the shorter tail, the larger teeth, the greater curva-

ture of jaws, the smaller size, and the *two* cutaneous expansions. Of twenty specimens the average proportional length of body and tail is as four and a half to eight. In no case is the tail twice as long as the disk. Color ochraceous brown; ventral surface light. Length of body of an adult male 9.4, length of tail 15, and width of pectorals 10 inches. Common in the rivers of Florida along the Gulf coast. Several specimens in the collection were captured in Lake Monroe, at a distance from the salt water, by Count Pourtalès.

#### DASIRATIS SAYL

Raja sayi Lesneur, Jour. Acad. Nat. Sci. Phil. i, p. 42, fig. Myliobatis sayi DeKay, New York Fauna, Fish. p. 376. Trygon sayi Müll. et Henle, Plagiostomen, p. 166. Myliobatis sayi, Storer, Syn. Fish. N. Amer. p. 262. Trygon sayi, Duméril, Elasmobranch, p. 603.

Disk quadrangular, about one-sixth wider than long, anterior margins nearly straight, posterior and inner borders convex, outer and posterior angles rounded. Snout not protruding beyond the lines of the margins. Ventrals rounded. Tail strong, rather more than one and a half times the length of the disk, with a strong serrated spine, bearing a short, low cutaneous expansion behind the spine on the upper side, and a longer, little wider one below, ending nearly opposite. Upper jaw undulated; lower prominent in the middle. Teeth small, smooth in young and females, sharp in adult males. Three papilla at the bottom of the month, and one at each side. Body and tail naked. Color olive brown in adult, reddish or yellowish in young; lower surface whitish. This species closely resembles the European species pastinaca. A comparison of specimens discovers the following differences: in Sayi the anterior margins form a more blunt angle at the end of the snout, which is less prominent at the apex, the outer and posterior extremities of the pectorals are rounder, the posterior margins are more convex, the disk is broader toward the ventrals, and the tail is longer; in pastinaca the lateral and hinder angles of the pectorals and the lateral angle of the ventrals are marked by blunted corners. A single small rounded tubercle on the middle of the back. There are specimens in the collection from New York, Pensacola, Bahia, and Rio Janeiro. A young female measured from snout to tail 7.1, length of tail 11, and width of pectorals 8.2 inches.

#### DASIBATIS HASTATA.

Trygon hastata DeKay, New York Fanna, Fish. p. 375, pl. 65, fig. 214 Q. Trygon hastata Storer, Syn. Fish. N. Amer. p. 261. Trygon hastata Dumérd, Elasmobranch. p. 592.

Disk quadrangular, about one-fourth wider than long; anterior margins nearly straight, meeting in a blunt angle on the end of the snort, curved near the outer angle to meet the slightly convex posterior margins: inner borders convex; outer and hinder angles rounded. Ventrals almost entirely covered by the pectorals, hinder margins convex. Tail more than one and a half times the length of the disk, low-keeled on the upper side, a long, broad membranous expansion below, roughened with small asperities, one or more serrated spines. Body smooth in young, very old with scattered small asperities. A row of narrow compressed tubercles along the middle of the back and on the base of the tail; the points of these tubercles are depressed and directed back-On each shoulder, parallel with the median, there is a shorter row, the length of which varies according to the age of the individual. Mouth with three papillae. Jaws with more curvature than those of centrura and less than those of sabina. Young without tubercles. Color bluish or olivaceous brown, darker on dorsum and tail, light on lower surface. Measurement of a young specimen: length of disk 8.5, width 10, and length of tail 14 inches. An adult male measured 20 inches across the pectorals and 16 in length of body. The museum contains specimens from Florida, Cuba, Pernambuco, and Rio Janeiro.

#### Dasibatis brevis.

(Garman, 1880, Bull. Mus. Comp. Zeöl. vi, 171.)

Disk quadrangular, a little wider than long. Anterior margins nearly straight, curved near the outer extremities to meet the convex posteriors, meeting in a blunt angle on the end of the snout. Outer and posterior extremities of pectorals round, without trace of angles. Ventrals broad, truncate, with angles rounded. Tail less than one and a half times the length of the disk, tapering to an acute point, depressed as far as to the spine, thence compressed to the end of the cutaneous fold, and round from this point to the tip, with a short elevated membraneous expansion behind the spine, and a longer and wider one on the lower side, extending below the former and the spine. The expansions have their hinder extremities opposed; they end quite abruptly and are widest near the

termination. Month with five papilla, outer small. Teeth small, blunt. Upper jaw indented in the middle; lower with a prominence in front. Disk naked in the young. Adult specimens have three rows of tubercles on the middle of the back disposed as are those of D, hastata. A large specimen from Payta has three large, erect, broad-based tubercles in front of the caudal spine, and the tail rough with smaller ones. The short rows on the shoulders contain from three to four, and probably increase in number with age, as is the case with the closely allied Atlantic coast species. Color light gravish or olivaceous brown, reddish near the edges, white below, with round spots of brownish under the base of the tail. Compared with D. hastata this species differs in the shorter tail, rounder extremities of the disk, and the shape and size of the tubercles and membraneous fins. D. hastata has no expansion on the top of the tail, and that on the lower side is very long, of moderate width, and tapers gradually. Those of D. brevis are comparatively short and broad: they rise gradually and terminate abruptly. From D. sayi this species is to be distinguished by the great development of the caudal expansions, their shape and length, and by the tubercles on shoulders and tail. A large female measures in length of body 17, tail 23, and width of pectorals 18 inches. A young male in length of body 8.1, tail 12, and width of pectorals 9.2 inches. Peru.

#### DASIBATIS DIPTERURA.

(Jordan & Gilbert, 1880, Proc. U. S. Nat. Mus. 31.)

Disk rhomboid, slightly broader than long; anterior margias nearly straight forwards, meeting in a very obtuse angle; posterior margins curved; lateral angles rounded. Tail nearly half longer than disk, with a conspicuous entaneous fold below, and a smaller but evident one above. Upper jaw considerably curved, with a slight convex protuberance in front, which fits into a slight emargination in the lower jaw, which is convex, its outlines corresponding to the curves of the upper jaw. Bands of teeth wider in front than laterally. Inside of mouth, behind the lower jaw, with three fleshy processes. Teeth about  $\frac{2}{2}$ ; about 8 in a cross-series in the upper jaw, and 10 in the lower. Color light brown, somewhat marbled with darker, but without distinct spots; tail blackish; belly white. Skin everywhere perfectly smooth in the young; adult with small tubercles along the back. San Diego, Cal.

Of the nine species enumerated above as belonging to American

waters one has been described from the Sandwich Islands. It is in view of the probability of its occurrence as an occasional visitor on our Western coasts that it is introduced.

As already noticed, in Volume VI, page 172, of the Bulletin of the Museum of Comparative Zoölogy, the species recently described by Dr. Günther, Trygon brachyurus and Trygon reticulatus, belong to the genus Potamotrygon, which includes the peculiar species of the family inhabiting the rivers of South America.

# CLASS IV.-PISCES.

(The True Fishes.)

Skeleton bony or cartilaginous. Skull with sutures; a lower jaw present; membrane bones developed in connection with the skull; gill-openings a single slit on each side, sometimes confluent; gills attached to bony arches, normally four pairs of them, their outer margins free. Median and paired fins usually developed; a lyriform shoulder-girdle. Exoskeleton various. Ova comparatively small. No "claspers". Brain-differentiated and distinctly developed. Heart developed, divided into an auricle, ventricle, and arterial bulb.

As here understood, this group includes the great majority of recent fishes, and is equivalent to the *Teleostei*, *Ganoidei*, and *Dipnoi* of most recent writers, the *Actinopteri*, *Crossopterygia*, and *Dipnoi* of Professor Cope. Omitting all notice of the *Dipnoi* and the *Crossopterygia*, all the members of which groups are extralimital and confined to the fresh waters of the tropics, it will be convenient to divide the American representatives of the class of *Pisces* into four series or subclasses—*Chondrostei*, *Holostei*, *Physostomi*, and *Physoclisti*, the first and second including most of the *Ganoidei* of Müller, the second and third the *Teleostei*. These groups are evidently of unequal value, the *Physostomi* and the *Physoclisti* being very intimately connected, and the relations of the *Holostei* with the *Physostomi* are probably more intimate than their relations with the other Ganoids, as has been shown by Professor Cope. Nevertheless, these groups exist in nature, and their recognition under one name or another is convenient.

#### ANALYSIS OF THE SUBCLASSES OF PISCES.

- a. Arterial bulb muscular, with numerous valves; optic nerves forming a chiasma; ventral fins abdominal; air-bladder with a duct; tail heterocereal.
  - (Series Ganoidel.\*)

    b. Ventral fin with an entire series of basilar segments; skeleton cartilaginous.

CHONDROSTEI

bb. Ventral fin with the basilar segments rudimental; skeleton bony... Holostel.

- aa. Arterial bulb with a pair of opposite valves; optic nerves not forming a chiasma.

  (Series Teleostel.\*)
  - c. Air-bladder (if present) connected by an air-duct with the stomach or esophagus; ventral fins (if present) abdominal, their basilar segments rudimental, usually without spines; parietal bones usually united.

Риуѕовтоми

cc. Air-bladder without duct; ventral fins (if present) usually thoracie or jugular, without basilar segments; spines usually present, at least in the dorsal and ventral fins; parietal bones separated by the supraoccipital.

Physoclisti.

#### ARTIFICIAL KEY TO THE FAMILIES OF PISCES.

The following key is intended simply to facilitate the identification of species. No attempt is made to indicate the natural characters or relations of the families, and only those species of any group which occur within the limits of the United States are taken into consideration.

#### I.-VENTRAL FINS PRESENT, ABDOMINAL.

\* Dorsal fins 2, the anterior chiefly of soft rays, the posterior adipose.

A. Body naked.

B. Head with 4 to 8 long barbels; dorsal and pectoral fins each with a spine.

SILURIDE, 29.

BB. Head without barbels; fins without spines.

AA. Body sealy.

DD. Teeth (if present) pointed.

E. Margin of upper jaw formed by the premaxillaries alone.

. Margin of upper jaw tormed F. Dorsal fin nearly median.

GG. Body without phosphorescent spots.

II. Head scaly; scales cycloid; teeth cardiform..... Scopelide, 42.

IIII. Head naked; scales etenoid; teeth villiform.. Percopside, 47.

FF. Dorsal fin posterior; teeth unequal; body elongate.. Paralepidæ,41.

EE. Margin of upper jaw formed by maxillaries posteriorly.

J. Body with phosphorescent spots; gill-rakers none.

Chauliodontidæ, 44.

JJ. Body without phosphorescent spots; gill-rakers present.

Salmonide, 46.

\*\* Dorsal fin single, preceded by free spines.

K. Body scaleless, naked or with bony plates.

L. Ventral fins I, 1, the spine strong; snout moderate.

Gasterosteidæ, 64.

LL. Ventral fins I, 5, the spine slender; snort prolonged.

<sup>\*</sup> τέλεος, perfect; ὀστέον, bone.

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*** Dorsal fins 2, the anterior of spines only, the posterior chiefly of soft rays,
                      M. Pectoral fin with 5 to 8 lowermost rays detached and file-
                             MM. Pectoral fin entire.
                       N. Snout tubular, bearing the short jaws at the end; body
                             NN. Snout not tubular.
                         O. Teeth strong, unequal; lateral line present.
                                                           Sphyrænidæ, 67.
                          OO. Teeth small or wanting; lateral line obsolcte.
                           P. Dorsal spines 4, stout; anal spines 3., MUGILID.E. 65.
                           PP. Dorsal spines 4 to 8, slender; anal spine single.
                                                            Atherinidæ, 66.
**** Dorsal fin soft-rayed, followed by a series of detached finlets.
                                                       Scomberesocide, 57.
***** Dorsal fin single, of soft rays only or with a single spine.
 a. Tail evidently beterocereal.
   b. Body naked; snort with a spatulate blade; month wide, without barbel.
                                                          Polyoboxtide, 25.
   bb. Body with 5 series of body shields; month inferior, toothless, preceded by 4
                                      barbels......Acipenseride, 25.
   bbb. Body scaly.
     c. Scales cycloid; a broad bony gular plate; dorsal fin many-rayed.
                                                                 Амирж. 28.
     cc. Scales ganoid; no gular plate; dorsal fin short......... Lephostende, 27.
 aa. Tail not evidently beterocercal.
       d. Body naked.
         e. Throat with a long barbel; no caudal filament; mouth large.
                                                             STOMIATIDE, 45.
         ee. Throat without barbel; caudal fin with a long filament; mouth small.
                                                           FISTULARIDE, 61.
         eec. Throat without barbel; no caudal filament; gill membranes joined to
                                      the isthmus......Cyprinide, 31.
       dd. Body scaly.
          f. Pectoral fins inserted near the axis of the body; lower pharyngeal
                                      bones fully united; lateral line along the
                                      sides of the belly...Scomberesocide, 57.
          ff. Pectoral fins inserted below the axis of the body; lower pharyngeals
                                      separate.
            q. Vent in front of ventral fins; eyes concealed.....Amblyopside, 48,
            gg. Vent behind ventral fins; eyes normal,
              h. Head scaly, more or less.
                i. Upper jaw not protractile, its lateral margin formed by the
                                      maxillaries.
                 j. Teeth eardiform; jaws depressed, prolonged.....Esocid.E, 51.
                  ii. Upper jaw protractile, its margin formed by premaxillaries
                                      alone.....Cyprinodontide, 49.
              hh. Head naked.
                    k, Gill-opening separated by an istlumus; month toothless;
                                      lower pharyngeals falciform.
                      U. Dorsal fin without serrated spine.
                        m. Dorsal fin with (usually) less than 10 (developed) rays;
                                      pharyngeal teeth few (less than 8).
                                                              Cyprinidæ, 31.
```

mm. Dorsal fin with (usually) more than 10 rays; pharyngeal teeth numerous....... Сатоятомир. Э. 30.

kk. Gill-openings not separated by an isthmus; lower pharyn. geal bones not falciform.

n. Throat without barbel; no phosphorescent spots.

o. Lateral line present.

p. Lower jaw with a gular plate; teeth villiform; fins with scaly sheaths..... Elopide, 36.

pp. Lower jaw without gular plate.

qq. Tongue without eanines.

r. Month black within: teeth all pointed.

Alepocephalidæ, 33

rr. Mouth pale within; teeth on roof and floor of mouth blunt and granular... Albulid.e., 34.

oo. Lateral line obsolete.

s. Lower jaw much shorter than upper.

t. Mouth small, toothless; maxillary not reaching beyond eye.. Dorosomatible, 38.

tt. Mouth very wide, the maxillary reaching much beyond eye..... Engraulide, 39.

## II.—VENTRAL FINS PRESENT, THORACIC OR JUGULAR.

A. Eyes unsymmetrical, both on the same side of the head .... PLEURONECTIDE, 123. AA. Eyes symmetrical.

B. Gill-openings in front of the pectoral fins.

C. Body more or less scaly or armed with bony plates.

D. Ventral fins completely united; gill membranes joined to the isthmus.

Совида, 104.

DD. Ventral fins separate.

E. Ventral rays I. 5.

F. Suborbital with a bony stay, which extends across the checks to or toward the preopercle; checks sometimes entirely mailed.

G. Pectoral fin with 2 or 3 lower rays detached and free.

Triglidæ, 108.

GG. Pectoral fin entire.

H. Slit behind fourth gill small or wanting.

I. Anal spines 3. . . . . . . . . Scorpænidæ, 106.

FF. Suborbital stay wanting; cheeks not mailed.

J. Spinous dorsal transformed into a lamellated sucking disk.

ECHENEIDIDE, 70.

JJ. Spinous dorsal (if present) not transformed into a sucking disk.K. Dorsal spines all or nearly all disconnected from each other.

LL. Body oblong or ovate, compressed.

M. Caudal peduncle very slender, the fin widely forked.

Carangidæ, 75.

KEY TO FAMILIES OF PISCES. 77
MM. Caudal peduncle stoutish, the fin little forked.  Stromateder, 77.
KK. Dorsal spines (if present) all, or most of them, connected by membrane.
N. Pectoral tin with 4 to 9 lowermost rays detached and filiformPolynemid.e, 68.
NN. Pectoral fineentire.
O. Dorsal and anal with detached finlets.
P. Anal preceded by 2 free spines Carangide, 75. PP. Anal not preceded by 2 free spines. Scombride, 74.
OO. Dorsal and anal without finlets.
Q. Lateral line armed posteriorly with keeled plates; 2 free anal spines.
Carangide, 75.
QQ. Lateral line unarmed.
R. Throat with 2 long barbels (placed just behind
chin)
RR. Throat without long barbels. S. Vomer with teeth.
T. Dorsal fin continuous, without distinct
spines,
U. Candal fin deeply forked; no pseudo-
branchiæCorypu.enib.e, 78.
UU. Candal fin rounded; pseudobranchiæ
presentlcostede, 101.
TT. Dorsal fin with a differentiated spinous part.
V. Gill membranes joined to the isthmus;
no lateral line Gobude, 104, VV. Gill membranes free from the isthmus.
W. Eyes lateral.
X. Anal fin preceded by 2 free spines.
- Scales cycloid, minute.
Carangidæ, 75.
Scales etenoid, moderate.
POMATOMIDE, 76.
XX. Anal fin not preceded by free spines.
Y. Tail keeledCarangid.e, 75.
YY. Tail not keeled.
Z. Anal spines none.
Serranidle, 86.
ZZ. Anal spines 1 or 2.
cales large, deciduous; month-nearly vertical
t Anal rays more than 20
ZZZ. Anal spines 3.
† Pseudobranchiæ small, glaudular, covered by skinCENTRARCHIDE, 84. †† Pseudobranchiæ large, exposed.
¶ Front teeth incisor-like, compressed
¶¶ Front teeth all pointed; no incisors.
§ Maxillary slipping under preorbital for its whole length.
Pristipomatide, 87.

\* Scales large, dec \*\* Scales smaller,

§§ Maxillary not slipping under preorbital posteriorlySERRANID.E, 83.  ZZZZ. Anal spines 4 to 10.
Centrarchidæ, 84.
WW. Eyes superior; mouth nearly verti-
calUranoscopidæ, 103.
SS. Vomer without teeth.
a. Tail with a strong spine on each side; teeth incisor-like TEUTHYDIDÆ, 99. aa. Tail without spine.
b. Anal preceded by 2 free spines; gill membranes free from isthmus.
Carangidæ, 75.
bb. Anal without free spines.
c. Teeth setiform; soft parts of vertical fins completely scaly; body compressed and elevated; analypines 3 or 4.
d. Dorsal fin continuous
dd. Dorsal fin deeply notched EPHIPPIDÆ, 97.
cc. Teeth not setiform.
e. Lateral line obsolete.
f. Gill membranes joined to the isthmus
ff. Gill membranes free from the isthmus
ec. Lateral line present.
g. Dorsal fin without distinct spines; no anal spinesIcosteidæ, 101.
gg. Dorsal fin with distinct spines.
h. Anal spines 1 or 2.
i. Lateral line interrupted; no slit behind fourth gill.
Pomacentridæ, 96.
ii. Lateral line complete, extending to the tip of the caudal fin; head
scalySclenidæ, 91,
iii. Lateral line complete, extending to the base of the caudal.
j. Upper jaw with posterior canines; dorsal fin continuous.
Trachinide, 102.
jj. Upper jaw without canines; dorsal fins 2Percide, 85.
hh. Anal spines 3.
i. Anal with more than 15 soft rays.
j. Preopercle entire
jj. Preoperele serrate
ii. Anal with less than 15 soft rays.
k. Dorsal spines 9 or 10.
l. Cheeks and opercles scaly
U. Checks and opercles chiefly naked LABRIDÆ, 95.
kk. Dorsal spines 11 to 15.
m. Upper jaw with posterior caninesLABRIDÆ, 95.
mm. Upper jaw without posterior canines.
* Jaws with incisors or molars, or both Sparidæ, 88.
** Jaws with pointed teeth only Pristipomatide, 87.
* kkk. Dorsal spines 17 or more; anterior teeth canine-like.
Labridæ, 95.
hhh. Anal spines 6
EE. Ventral rays more than I, 5.
n. Candal fin wanting; seales spinous MACRURIDÆ, 121.
nn. Candal fin well developed,
o. Tail isocereal; ventrals jugularGADIDÆ, 120.
oo. Tail diphycercal.
p. Ventral rays about 15; dorsal fin single, elevated.
Lampridide, 80.

pp. Ventral rays about I, 7.
q. Dorsal spines 3 or 4; vent anterior.
Aphredoderidæ, 83,
qq. Dorsal spines about 11; vent normal; scales
large, very rough.
Berycide, 82.
qqq. Dorsal spines about 10; vent normal; scales
minuteZenide, 81.
<b>EEE.</b> Ventral fins with or without spine; the number of soft rays less than 5.
r. Dorsal fin composed of spines only.
s. Dorsal fin extremely highBramide, 79.
ss. Dorsal fin lowBlennhdæ, 112,
rr. Dorsal tin of spines anteriorly, of soft rays posteriorly.
t. Pectoral fins entire.
u. Body entirely covered with series of bony
platesTriglidæ, 108.
uu. Body not mailed.
v. Suborbital with a bony stay.
Соттід. 107.
rr. Suborbital without bony stay.
BLENNIDÆ, 112.
• tt. Pectoral fin divided to the base in two un-
equal partsTriglide, 108.
rrr. Dorsal fin of soft rays anteriorly, of low spines
posteriorlyZoarcide, 115.
rrrr, Dorsal fin of soft rays only,
w. Dorsal fin very short; body mailed.
Triglide, 108.
ww. Dorsal fin very long; body with
small scales.
x. Dorsal and anal joined to the cau-
dal; pseudobranchiæ present.
y. Gill membranes joined to the isth-
musZOARCID.E, 115.
yy, Gill membranes free from the
istlanusOPHIDHDÆ, 118.
<b>27.</b> Dorsal and anal free from the caudal on marks as to be a sample
dal or nearly so; no pseudo- branchiæ.
z. Tail isocercal; chin usually with
a barbel
zz. Tail diphycereal, no barbel.
Brotulide, 119.
CC. Body scaleless, smooth or armed with tubercles, prickles, or scattered bony
plates.
*Breast with a sucking disk.
A. Gill membranes free from the isthmus; no spinous dorsalGobiesocide, 111.
AA. Gill membranes joined to the isthmus.
B. Skin smooth Liparidite, 109,
BB. Skin with tubercles or spines
**Breast without sucking disk.
C. Ventrals completely united
CC. Ventrals separate.
•

D. Dorsal and anal fins followed by finlets.  E. Free anal spines 2
EE. Free anal spines none
DD. Dorsal and anal without finlets.
F. Upper jaw prolonged into a "sword"XIPHIDE, 72.
FF. Upper jaw not prolonged into a sword.
G. Suborbital with a bony stay
GG. Suborbital without bony stay.
H. Anal fin absent; candal fin rudimentary or directed upward.
Trachypteridæ, 100.
I. Ventral rays less than I. 5.
J. Dorsal spines none at all; lateral line with prickles.
Icosteide, 101.
JJ. Dorsal spines very few (less than 6) Batrachdee, 114.
JJJ. Dorsal spines numerousBLEXNIDÆ, 112.
H. Ventrals thoracie. I, 5, or more.
K. Dorsal with a series of bony plates at base Zenide, 81.
KK. Dorsal without bony plates at base.
L. Anal preceded by 2 free spines
BB. Gill-openings small, behind the pectoral fins, which are more or less pedic-
ulate.
M. Gill-openings in or behind upper axil of pectorals;
mouth smallMaltheide, 123.
MM. Gill-openings in or behind lower axil; month large.
N. Head compressed; no pseudobranchiae.
Antennaridæ, 125.
NN. Head depressed; pseudobranchiæ present. Lophidæ, 124.
25/71 1111D/2017 1/0 11
HL-VENTRAL FINS ENTIRELY WANTING.
IIIVENTRAL FINS ENTIRELY WANTING.
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HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  SYNAPHOBRANCHDÆ, 54.  B. Gill-openings lateral, or not confluent.
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  SYNAPHOBRANCHIDÆ, 54.
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  SYNAPHOBRANCHIDÆ, 54.  B. Gill-openings lateral, or not confluent.  C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  Synaphobranchdæ, 54.  B. Gill-openings lateral, or not confluent. C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.  L. Molar teeth present.  Anarrinchadidæ, 113.
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped. Synaphobranchdee, 54.  B. Gill-openings lateral, or not confluent. C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only. C. Molar teeth present. Anarrhichadide, 113. EE. Molar teeth none. Blennide, 112.
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped. Synaphobranchde, 54.  B. Gill-openings lateral, or not confluent. C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only. C. Molar teeth present ANARRIHCHADIDE, 113. EE. Molar teeth none BLENNIDE, 112.  DD. Dorsal fins two, anterior spinous, posterior soft; teeth incisor-like.
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped. Synaphobranche, 54.  B. Gill-openings lateral, or not confluent. C. Gill membranes united to the isthmus (i. c., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only. L. Molar teeth present. Anarrhichadide, 113. EE. Molar teeth none. Blennide, 112.  DD. Dorsal fins two, anterior spinous, posterior soft; teeth incisor-like. Balistide, 128.
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  SYNAPHOBRANCHIDÆ, 54.  B. Gill-openings lateral, or not confluent. ('. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.  E. Molar teeth present
A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  Synaphobranelle, 54.  B. Gill-openings lateral, or not confluent.  C. Gill membranes united to the isthmus (i. c., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.  E. Molar teeth present
A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  Synaphobranchide, 54.  B. Gill-openings lateral, or not confluent.  C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.  E. Molar teeth present
A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  Synaphobranchee, 54.  B. Gill-openings lateral, or not confluent.  C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.  E. Molar teeth present
A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  Synaphobranchee, 54.  B. Gill-openings lateral, or not confluent. C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only. C. Molar teeth present. Anarrhichadde, 113. EE. Molar teeth none BLENNIDE, 112.  DD. Dorsal fins two, anterior spinous, posterior soft; teeth incisor-like. Balistide, 128.  DDD. Dorsal fin undivided, the spines feeble or none. E. Snout tubular, bearing the short, toothless mouth at its end; body mailed. F. Caudal fin present; head in the line of the axis of the body.  Syngnathde, 58.  FF. Caudal fin wanting; head not in line of axis of body.  Hippocampide, 59.
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  SYNAPHOBRANCHIDÆ, 54.  B. Gill-openings lateral, or not confluent.  C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.  E. Molar teeth present
A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  Synaphobranchee, 54.  B. Gill-openings lateral, or not confluent.  C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.  E. Molar teeth present
HI.—VENTRAL FINS ENTIRELY WANTING.  A. Gill-openings ventral, confluent in a longitudinal slit; body cel-shaped.  SYNAPHOBRANCHIDÆ, 54.  B. Gill-openings lateral, or not confluent.  C. Gill membranes united to the isthmus (i. e., gill-openings separated by an isthmus).  D. Dorsal fin single, of spines only.  E. Molar teeth present

J. Jaws attenuate, forming a long, snipe-like beak.

**NEMICHTHYIDÆ**, 56.

JJ. Jaws not attenuate.

K. Tail tapering into a filament......SACCOPHARYNGIDÆ, 54.

M. Maxillaries and premaxillaries distinct....ZOARCIDE, 115.
MM. Maxillaries and premaxillaries more or less coalescent
with yomer and palatines.

ANGUILLIDE, 53.

GG. Body not cel-shaped.

N. Breast with a sucking disk.

O. Skin smooth LIPARIDIDÆ, 109.
OO. Skin tubercular CYCLOPTERIDÆ, 110.

NN. Breast without sucking disk.

P. Teeth in each jaw confluent into one.

Q. Body compressed, rough....ORTHAGORISCH.E, 131. QQ. Body not compressed, spinous...DIODONTID.E, 130. PP. Teeth in each jaw confluent into two.

Tetrodontidæ, 129.

PPP. Teeth separate.

R. Body enveloped in a bony box...OSTRACHDÆ, 127. RR. Body not mailed....... STROMATEIDÆ, 77.

CC. Gill membranes free from the isthmus.

S. Vent at the throat.

T. Vertical'fins confluent; body cel-shaped.

Fierasferidæ, 117.

TT. Vertical fins separate; body oblong.

Amblyopsidæ, 48.

SS. Vent posterior.

U. Caudal fin wanting; body naked.

TRICHIURIDÆ, 73.

UU. Candal fin present.

V. Upper jaw prolonged into a sword.

Хіршида, 72.

VV. Upper jaw not prolonged into a sword.W. Body ovate, much compressed.

STROMATEIDÆ, 77.

WW. Body oblong or elongate.

X. Gillmembranes broadly united; teeth present.

Y. Dorsal fin of spines only.

BLENNIIDE, 112.

YY. Dorsal fin of soft rays only.

Congrogadidæ, 116.

YYY. Dorsal fins 2, anterior spinons, posterior soft .... Cottide, 107.

XX. Gill membranes separate.

Z. Jaws toothless, the lower jaw projecting....Ammodytidæ, 69.

ZZ. Jaws with teeth, lower not projecting....OPHIDHDE, 118.

Bull, Nat. Mus. No. 16-6

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## SUBCLASS CHONDROSTEL

(The Sturgeons.)

Skeleton partly cartilaginous. Ventral fin abdominal, with an entire series of basilar segments. No suboperculum or preoperculum. Branchiostegals (single or) wanting; a præcoracoid arch; no symplectic bone. Mesopterygium distinct; interclavicles present.\* Arterial bulb with several pairs of valves. Optic nerves forming a chiasma. Intestine with a spiral valve. Air-bladder connected by a duct with the æsophagus. Tail heterocercal, its fin with fulcra. Skin naked or armed with bony plates. This group comprises two orders.

(Order Chondrostei Günther, viii, 332-347. χονδρος, cartilage; ὁστέον, bone.)

ANALYSIS OF ORDERS OF CHONDROSTEI.

## ORDER G.—SELACHOSTOMI.

(The Paddle-fishes.)

A præcoracoid arch; no symplectic bone; premaxillary forming mouth border; no suboperculum, preoperculum, nor interoperculum; mesopterygium distinct; basihyals and superior ceratohyal not ossified; interclavicles present; maxillaries obsolete; branchihyals cartilaginous. This order contains but one family, Polyodontidw. ( $\sigma z \lambda \acute{a} \chi \eta$ , shark;  $\sigma \tau \acute{b} \mu a$ , mouth.)

## Family XXV.—POLYODONTIDÆ.

(The Paddle-fishes.)

Body fusiform, little compressed, covered with mostly smooth skin. Snout prolonged, expanded into a thin, flat blade, the inner portion formed by the produced nasal bones, the outer portion with a reticulate bony frame-work, the whole somewhat flexible. Mouth broad, terminal, but overhung by the spatulate snout, its border formed by the premaxillaries, the maxillaries being obsolete. Jaws with many fine decid-

<sup>\*</sup> The osteological characters here and elsewhere in this work are mostly taken from Cope's "Contribution to the Ichthyology of the Lesser Antilles". Trans. Am. Phil. Soc. 1870.

nous teeth. Similar teeth on the palatines. No tongue. Spiracles present. Operculum rudimentary, its skin produced behind into a long, acute flap. No pseudobranchiæ nor opercular gill. Gills 4½. Gillrakers long, in a double series on each arch, the series divided by a broad membrane. Gill membranes considerably connected, free from the isthmus. A single broad branchiostegal. No barbels. Nostrils double, at base of blade. Lateral line continuous, its lower margin with short branches. Dorsal fin well back, of soft rays only. Anal similar, rather farther back. Tail heterocercal, the lower caudal lobe well developed, so that the fin is nearly equally forked. Sides of the bent portion of the tail armed with small rhombie plates. Caudal fin with fulera. Pectorals moderate, placed low. Ventrals abdominal, many-rayed. Airbladder cellular, not bifid. Pyloric cœca in the form of a short, broad, branching, leaf-like organ. Intestine with a spiral valve.

Two genera known, *Polyodon* and *Psephurus*, each of one species. Singular fishes, inhabiting the fresh waters of the United States and China. They feed chiefly on mud and minute organisms contained in it, stirring it up with the spatulate snout.

(Polyodontidæ Günther, viii, 346-347.)

\* Gill-rakers very fine and numerous; caudal fulcra small and numerous.

POLYODON, 46.

## 46.-POLYODON Lacépède.

### Paddle-fishes.

(Spatularia Shaw: Platirostra Le Sueur.)

Lacépède, Hist. Nat. Poiss. i, 402, 1798: type "Polyodon feuille" = P. folium Bloch.) Gill-rakers exceedingly numerous, very slender; spatula broad. Caudal fulcra 13 to 20 in number, of moderate size. Rivers of the United States.  $(\pi o \lambda \delta z, \text{ many}; \delta \delta \tilde{\omega} \nu, \text{ tooth.})$ 

73. P. spathula (Walb.) J. & G.—Paddle-fish; Spoon-bill Cat; Duck-bill Cat.

Color olivaceous, rather pale. Opercular flap very long, nearly reaching to ventrals. Spatula broad. Premaxillary extending far behind the small eye. Skin smooth, or nearly so, except the rhombic plates on the sides of the tail. Ventrals near the middle of the body; dorsal well behind them; anal mostly behind the dorsal, and somewhat larger; these fins somewhat falcate. Fin-rays slender. Spiracle with a minute barbel. Isthmus papillose in the young. Spatula 2½ to 4 times in length. Whole head, with opercular flap, more than half length. Head, without spatula or flap, about 5. D. 50-60; A. 50-65; V. 45.

L. 5-6 feet. Mississippi Valley and rivers of the Southern States; generally abundant.

(Squalus spathula Walbaum, Artedi Pisc. 1792, 522: "Polyodon feuille" Lacépède, Hist. Nat. Poiss. i, 402: P. folium Schneider ed. Bloch, Syst. Ichth. 457: Spatularia reticulata Shaw, Gen. Zoöl. 1804, v, 362: Platirostra edentula (adult) Le Sueur, Journ. Acad. Nat. Sci. Phila. 227: P. folium Günther, 346.)

## Order H.—GLANIOSTOMI.

(The Sturgeons.)

A præcoracoid arch. No symplectic bone. Maxillary present. No suboperculum or preoperculum. Interoperculum present. Mesopterygium distinct. Interclavicles present. Basihyals and superior ceratohyal not ossified. Branchihyals osseous. This group is composed of the single family Aeipenseridæ. (γλανίς, a cat-fish, Silurus; στόμα, mouth.)

## FAMILY XXVI.—ACIPENSERIDÆ.

(The Sturgeons.)

Body elongate, subcylindrical, armed with five rows of bony bucklers, each with a median carina which terminates in a spine. A median dorsal series, and a lateral and abdominal series on each side, the abdominal series sometimes decidnous. Between these the skin is rough, with small irregular plates. Snout produced, depressed, conical or subspat-Mouth small, inferior, protractile, with thickened lips. teeth. Four barbels in a transverse series on the lower side of the snout in front of the mouth. Eyes small; nostrils large, double, in front of eye. Gills 4. An accessory opercular gill. Gill membranes united to the isthmus. No branchiostegals. Maxillary bone distinct from the premaxillary. Head covered with bony plates united by sutures. Finrays slender, all articulated. Vertical fins with fulcra. placed low. Ventrals many-rayed, behind middle of body. placed posteriorly. Anal somewhat behind it, similar. Tail heterocercal, the lower candal lobe developed. Air-bladder large, simple, connected with the esophagus. Pseudobranchiæ small or obsolete. ach without blind sac. Rectum with a spiral valve. Pancreas divided into pyloric appendages.

Large fishes of the seas and fresh waters of northern regions. Most of the species are migratory, like the salmon, which are found in the same waters. Genera 2, species about 20, although more than five times that number have been described. The American species especi-

ally have been unduly multiplied, particularly by Auguste Duméril, who has found upwards of forty of them in the museum at Paris. The actual number of American sturgeons does not exceed 7, and is more likely still less. The changes with age are considerable; the snout in particular becomes much shorter and less acute, and the roughness of the scales is greatly diminished; the ventral shields sometimes disappear altogether. The number of plates, although one of the best specific characters, is subject to considerable variations.

(Acipenseridæ Günther, viii, 332-345.)

ACIPENSER, 47.

#### 47.—ACIPENSER\* Linnæus.

#### Sturgeons.

(Artedi, Linn. Syst. Nat.: type Acipenser sturio L.)

Snout subconical, more or less depressed below the level of the fore-head. A small spiracle over the eye. Caudal peduncle moderately long, deeper than broad, the rows of bony bucklers distinct to the base of the caudal fin. Tail not produced into a filament, its tip surrounded by the caudal rays. Gill-rakers small, narrowed or lanceolate. Pseudobranchiæ present. Species numerous. (Latin acipenser, a sturgeon; from azes, point; πεντα, five?)

#### 74. A. Sturio L.—Common Sturgeon.

Snout rather sharp, nearly as long as the rest of the head, becoming comparatively shorter and blunter with age. Barbels nearly midway between mouth and tip of snout, shortish, not reaching the mouth. Gill-rakers small, slender, pointed, sparse, not longer than the pupil.

<sup>\*</sup> Spiracles present; snout subconic; rows of bony shields distinct throughout.

<sup>\*\*</sup> Spiracles obsolete; snout subspatulate; rows of bony shields confluent on the tail.

SCAPHIRRHYNCHOPS, 48.

<sup>\*</sup> M. Duméril (Hist. Nat. Poiss. ii, 89) divides this group into six subgenera, as follows:

a. Spines of dorsal shields situated near their middle. (Mesocentres.)

b. Stellate plates none.

aa. Spines of dorsal shield at the posterior extremity. (Opisthocentres.)

d. Stellate plates none.

The same species at different ages may frequently belong to two or more of these subgenera.

Fulera roughish, not enlarged. Lower lobe of tail rather sharp. Sides of tail with regular rhombic plates. Plates mesocentrous, rather rough. Anal smaller than dorsal, placed mostly below it. Anterior rays of pectoral thickened. "Skin with very small rough points in very young examples; in older ones these ossifications are broader, rough, substellate, and more or less regularly arranged in oblique series." D. 40–44; A. 26–30. Dorsal plates 11–14; lateral 27–36; ventral plates 11. Atlantic Ocean; ascending rivers of Europe and North America.

Var. oxyrrhynehus (Mitchill), the American Sturgeon, has the number of lateral plates generally fewer—27–29 instead of 29–36, as in European examples. The stellate ossifications are also said to be somewhat rougher than in the European form. Massachusetts to Florida; abundant.

(L. Syst. Nat.; Günther, viii, 342: Acipenser oxyrhynchus Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 462, and of most American writers.)

# 75. A. transmontanus Richardson.—White Sturgeon; Columbia River Sturgeon; Sacramento Sturgeon.

Color dark grayish, scarcely olive-tinged, and without stripes. Dorsal shields mesocentrous, with a compressed bluntish spine, which is anteriorly often serrated, and followed behind by a compressed keel. Lateral shields rather opisthocentrous. Skin with stellate roughnesses, but smoother than in A. medirostris. Snout sharp in the young, becoming rather blunt and short in the adult, when it is considerably shorter than the rest of the head. Barbels rather nearer to the tip of snout than to the mouth. Gill-rakers comparatively long, more than 3 times as high as broad, about 26 in number. Upper lobe of tair with rhombic plates. First caudal fulcrum, above and below, enlarged and granular. Lower lobe of caudal rather sharp and long, not much shorter than upper. Dorsal plates 12; lateral 36-49, usually about 44; ventral 10. Anal fin mostly below dorsal. D. 45; A. 28. Depth 7 in length; head 4. Pacific coast, south to Monterey, ascending the Sacramento, Columbia, and Fraser's Rivers in large numbers in spring. Reaches a weight of 300 to 600 pounds, and is used as food.

(Richardson, Fauna Bor.-Amer. iii, 278, 1836: Acipenser brachyrhynchus and acutirostris (young) Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 15, 16: Acipenser transmontanus and brachyrhynchus Günther, viii, 336, 337.)

#### 76. A. medirostris Ayres.—Green Sturgeon.

Color olive-green, with an olive stripe on the median line of the belly and one on each side above the ventral plates, these stripes ceasing opposite the vent. Shields generally opisthocentrous, with a strongly hooked spine. Skin very rough. Snout about as in A. transmontanus, sharp in the young, becoming blunt with age, usually rather shorter than the rest of head. Barbels nearly midway between snout and mouth. Gill-rakers scarcely higher than broad, about 17 in number. Upper lobe of tail with some scattered plates. Caudal fulcra not enlarged. Lower lobe of caudal short and blunt, little more than half the length of the upper. Dorsal plates 10; lateral 28–30; ventral 9. Anal fin about half below the dorsal. D. 37; A. 30. Depth 7½ in length; head 4½. Pacific coast, ascending the rivers from San Francisco northward, reaching a large size. Less abundant than A. transmontanus; not used for food, being reputed poisonous.

(Ayres, Proc. Cal. Acad. Nat. Sci. i, 15; Günther, viii, 342; Acipenser agassizi Günther, viii, 344; Acipenser acutivostris Günther, viii, 344; not of Ayres.)

# 77. A. Pubicumdus Le Sueur.—Lake Sturgeon; Ohio Sturgeon; Black Sturgeon; Stone Sturgeon; Rock Sturgeon.

Blackish above, sides paler or reddish. Body comparatively elongate; snout slender and long in the young, becoming quite blunt with age, when it is considerably shorter than the rest of the head; shields large, rough with strongly hooked spines, becoming later comparatively smooth. Skin with minute rough plates. Ventral shields growing smaller with age, and finally deciduous. Dorsal shields 13 (11–16); lateral shields (34) 30–39; ventral plates 8–10. D. 35; A. 26. L. 6 feet. Weight 50 to 100 pounds. Mississippi Valley, Great Lakes, and northward. Our common fresh-water sturgeon, usually not descending to the sea.

(Le Sueur, Trans. Amer. Phil. Soc. i, 1818, 388; Acipeuser maculosus Le Sueur, Trans. Amer. Phil. Soc. i, 393; Acipeuser rupertianus Richardson, Fauna Bor.-Amer. iii, 311; Acipeuser carbonarius, lavis, and rhynchaus Agassiz, Lake Superior, 271, 276; Acipeuser rubicundus, maculosus, and liopeltis Güuther, viii, 338, 339, 341; Milner, Rept. U. S. Fish Com. 1872-73, 67.)

#### 78. A. brevirostris Le Sueur.—Short-nosed Sturgeon.

"Snout very short and obtuse, about one-fourth of the length of the head. Barbels short, simple. Osseous shields rather small and distant from one another, finely radiated and granulated; 8-10 on the back, 22-28 on the sides, 6-8 along the abdomen. Skin very sparingly covered with minute prickles and very small scattered ossifications. The greater part of the anal below the dorsal. D. 30." (Günther.) Cape Cod to Florida.

(Le Sueur, Trans. Amer. Phil. Soc. i, 390; Günther, viii, 341.)

#### 48.-SCAPHIRRHYNCHOPS Gill.

### Shovel-nose Sturgeons.

(Scaphirhyuchus Heckel, Ann. Wiener Mus. Naturgesch. i, 1835, 71; preoccupied in ornithology.)

(Scaphirhynchops\* (Gill, MSS.) Jordan & Copeland, Bull. Buff. Soc. Nat. Hist. 1876, 161; type Acipeuser platorynchus Rafinesque.)

Snout broad, depressed, subspatulate or shovel-shaped. No spiracle. Caudal peduncle very long, strongly depressed, broader than deep. Rows of bony bucklers confluent below the dorsal fin, forming a complete coat of mail on the tail. Tail produced in a filament beyond the caudal fin. Gill-rakers somewhat fan-shaped. Pseudobranchiæ obsolete. Species about 4, inhabiting the fresh waters of the United States and Central and Eastern Asia. ( $\sigma z \acute{a} \varphi \eta$ , spade;  $\acute{\rho} \acute{\nu} y \chi o z$ , snout;  $\check{a} \psi$ , appearance.)

79. S. platyrrhynchus (Rafinesque) Gill.—Shovel-nosed Sturgeon; White Sturgeon.

Body elongate, tapering into a slender, depressed tail, which extends beyond the caudal fin in the form of a filament. This filament is long and slender in the young, but is frequently lost in the adult. Bony shields opisthocentrous, sharply keeled, the series confluent below the dorsal, obliterating the smaller plates between. Two occipital plates with short keels. A spine in front of eye, and one at the posterior edge of the rostral "shovel"; snout in the young with a few spines. Barbels nearer mouth than tip of snout. Greatest width of head about half its length. None of the fulcra enlarged. Dorsal and anal small. Anal partly below dorsal. Gill-rakers small, lamellate, somewhat fan-shaped, ending in 3-4 points. Dorsal shields 15-18; lateral 41-46; ventral 11-13. Head 4 in length. L. 5 feet. Mississippi Valley and streams of the Western and Southern States; common.

(Acipenser platorhynchus Rafinesque, Ichth. Oh. 1820, 80: Scaphirhynchus rafinesquei Heckel, Ann. Wiener Mus. Naturgesch. i, 1835, 71: Scaphirhynchus cataphractus Günther, viii, 345.)

## SUBCLASS HOLOSTEL

(The Bony Ganoids.)

Skeleton bony. Ventral fin abdominal, with the basilar segments rudimentary, as in ordinary fishes. Primary radii of posterior limb generally reduced to one rudiment. Suboperculum and preoperculum present.

<sup>\*&</sup>quot; In words beginning with  $\dot{\rho}$ ,  $\dot{\rho}$  is doubled after a prefix" (Liddell & Scott, Gr.-Engl. Lex. 1858, 213); hence Scaphirrhynchops, Hemirrhamphus, and all similar words are properly written with the double r.

Branchiostegals present. Coronoid bone and praecoracoid arch present. Arterial bulb with several pairs of valves. Optic nerves forming a chiasma. Intestine with a spiral valve. Air-bladder cellular, lung-like, connected by a sort of glottis with the æsophagus. Tail heterocercal. Skin covered with scales, which are ganoid or cycloid. As here understood, this group consists of the two orders Ginglymodi and Halecomorphi, the Crossopterygia being considered as forming a distinct subclass. The Chondrostei, Holostei, and Crossopterygia form the series or subclass Ganoidei, represented by five widely divergent families among recent fishes and by a great variety of extinct types. These forms, so far as known, agree in a number of respects already indicated, and differ from all the Teleostei, or ordinary fishes, in the presence of several pairs of valves in the arterial bulb, and in the presence of the optic chiasma. The relations of the Halecomorphi with the Teleostean order of Isosponduli are, however, undoubtedly very close.

(Ganoidei Holostei part Günther, viii, 324-325, 328-331. δλος, complete; δστέον, bone.)

ANALYSIS OF ORDERS OF HOLOSTEI.

- \* Vertebræ opisthocælian; maxillary bone transversely divided into several pieces.

  GINGLYMODI, I,
- $\ensuremath{^{**}}$  Vertebræ amphicælian; maxillary bone not transversely divided.

Halecomorphi, J.

## ORDER L-GINGLYMODI.

(The Gar Pikes.)

Parietals in contact. Pterotic, basis cranii, and anterior vertebræ simple. Symplectics present. Mandible with opercular, coronoid, angular, articular, and dentary bones. Third superior pharyngeal small, lying on fourth. Upper basihyal wanting. Maxillary transversely divided. A cartilaginous præcoracoid arch. Vertebræ opisthocælian. Pectoral fins with mesopterygium and five other basal elements. Tail heterocereal. This order includes the single family Lepidosteidæ. (γιγγλομός, hinge; δδούς, tooth.

## FAMILY XXVII.—LEPIDOSTEIDÆ.

(The Gar Pikes.)

Body elongate, subcylindrical, covered with hard, rhombic, ganoid scales or plates, which are imbricated in oblique series running downward and backward. Both jaws more or less elongate, spatulate or beak-like, the upper jaw projecting beyond the lower. Premaxillary

forming most of the margin of the upper jaw; the maxillary transversely divided into several pieces. Lower jaw composed of as many pieces as in reptiles. Coronoid present. Both iaws with an outer series of small teeth, followed by one (or two) series of large teeth, besides which on the jaws, yomer, and palatines are series of small, close-set, rasp-like teeth. Tongue toothless. Large teeth of the jaws conical in form, pointed and striate, placed at right angles to the jaw. These large teeth rest, according to Agassiz, in a rather deep furrow, protected on the outside by the raised border of the jaw, and on the inside by a ridge of the same nature. These teeth are pierced in the centre by a foramen, which communicates with the maxillary canal, and through which the nerves and blood vessels enter the pulp cavity of the tooth. The forms of the folded layers of dentine within the teeth are peculiar. Pharyngeals with rasp-like teeth. Tongue short, broad, emarginate, free at tip. External bones of skull very hard and rugose. Eyes small. Nostrils near the end of the upper jaw. An accessory gill on the inner side of the opercle. Pseudobranchiæ present. No spiracles. Gills four, a slit behind the fourth. Branchiostegals 3. Gill membranes somewhat connected, free from the isthmus. Gill-rakers very short. Air-bladder cellular, lung-like, somewhat functional, communicating by a glottis with the œsophagus. Fins with fulcra. Dorsal fin short, rather high, posterior, nearly opposite the anal, which is similar in form. Tail heterocercal, in the young produced as a filament beyond the caudal fin. convex. Ventrals nearly midway between pectorals and anal. Pectoral and ventrals moderate, few-rayed. Vertebræ with ball-and-socket joints (opisthocalian). Stomach not caecal. Pyloric appendages numer-Spiral valve of intestines rudimentary. Fishes of the fresh waters of North America. Genera 1 or 2; species probably 3 or 4, although more than 40 have been described. These fishes are of much interest to geologists from their relationship to extinct Ganoid types.

(Lepidosteidæ Günther, viii, 328, 331.)

#### 49.—LEPIDOSTEUS Lacépède.

#### Gar Pikes.

(Lepisosteus Lacépède, Hist. Nat. Poiss. v, 331, 1803: type Lepisosteus gavialis Lac. = Esox osseus L.)

This genus is characterized by the presence of but one row of large teeth in each jaw. There are in the upper jaw, first, the outer series of

<sup>\*</sup> Large teeth of the upper jaw in a single series (in adult)......Lepidosteus, 49.

<sup>\*\*</sup> Large teeth of upper jaw in two series......LITHOLEPIS, 50.

small, sharp, even teeth, then the series of large teeth, some of the anterior teeth being usually movable. Next comes a series of fine teeth, in one row in front, becoming a band behind. Then the vomerine teeth also in a long band, and posteriorly outside of the vomerine band a palatine band. These bands on the roof of the mouth are frequently somewhat confluent or irregular. In young specimens some of the palatine teeth are often enlarged, sometimes forming a regular series. Lower jaw with an outer series of small teeth, then a series of large teeth, then a broad band of fine teeth on each side. No teeth on tongue. Each of the large teeth fitting into a depression in the opposite jaw. Waters of the United States. ( $\lambda z\pi iz$ , scale;  $\partial \sigma z z i\sigma z$ , bone.)

\* Beak long and slender; the snout more than twice the length of the rest of the head. (Lepidosteus.)

## 80. L. osseus (L.) Agassiz.—Long-nosed Gar; Bill-fish; Common Gar Pike.

Olivaceous, pale and somewhat silvery below. Vertical fins and posterior part of the body with round black spots, which are more distinct in the young. Very young with a blackish lateral band. Snout a little more than twice the length of the rest of the head, its length 15–20 times its least width. Head 3 in length; depth 12. D. 8; A. 9.; V. 6; P. 10; Lat. l. about 62. L. about 5 feet. Great Lakes and rivers of the United States from Vermont to the Rio Grande; generally abundant.\*

(Esox osseus Linn. Syst. Nat.: Lepisosteus oxyurus Raf. Ichth. Oh. 73: Lepisosteus huronensis Richardson, Fanna Bor.-Amer. iii, 257; Günther, viii, 330.)

#### 81. L. platystomus Raf.—Short-nosed Gar.

Colors of *L. osseus* or rather darker. Snout usually about one-third longer than the rest of the head, sometimes about equal to it, its length 5-6 times its least width. Head 3½ in length; depth 8. D. 8; A. 8; V. 6; Lat. l. about 56. L. 2-3 feet. Great Lakes and southern and western rivers, with the preceding, but less abundant northward.

(Lepisosteus platostomus Ratinesque, Ichth. Oh. 72; Günther, viii, 329.)

<sup>\*\*</sup> Beak shorter and broader, little longer than the rest of the head. (Cylindrostcust Rafinesque.)

<sup>\*</sup> M. Auguste Duméril (Hist. Nat. Poiss.) divides this species, as represented in the Museum at Paris, into seventeen, which are distinguished by trifling differences in proportions and numbers of scales. It is seldom safe to found either a species or a genus of fishes on differences in proportions alone.

<sup>†</sup> Rafinesque, Ichth. Oh. 1820, 72: type Lepisosteus platostomus Raf. (κυλινδρος, cylinder; δστεόν, bone.)

#### 50.—LITHOLEPIS Rafinesque.

## Alligator Gars.

(Atractosteus Rafinesque, 1820.)

(Rafinesque, Amer. Month. Mag. iii, 447, 1818: type Litholepis adamantinus Raf.)

This genus is scarcely distinct from Lepidosteus, differing only in the presence of a second series of large teeth in the upper jaw, along the onter margin of the palatine bones, at their junction with the premaxillaries. Probably but one species, in the warmer parts of the United States, and southward to Cuba and Central America. (λίθος, stone;  $\lambda \varepsilon \pi i \varepsilon$ , scale.)

### 82. I. tristerchus (Bloch & Schneider) Jordan & Gilbert.-Alligator Gar.

Color greenish, paler below, the adult usually not spotted. Snout usually not quite so long as the rest of the head, its least width contained 3½ times in its length. Head 3½ in length. D. 8; A. 8; V. 6; Lat. 1. 60. Scales in an oblique series from the ventrals to middle of back 18-20. L. 8-10 feet. Rivers of the Southern States, Cuba, Mexico, and Central America; reaching a great size.

(?? Esox viridis Gmelin ed. Linné, i, 1380: Esox tristæchus Schneider ed. Bloch, 395: Lepisosteus spatula Lacép. v, 333: Lepisosteus or Atractosteus ferox Rafinesque, Ichth. Oh. 73: Levidosteus manjuari Poey, Mém. Cuba, i, 273: ? Atractosteus tropicus Gill, Proc. Acad. Nat. Sci. Phila. 1863, 172: Lepidostcus viridis Günther, viii, 329.)

## ORDER J.—HALECOMORPHI.

(The Amias.)

Parietals in contact. Pterotic, basis cranii, and anterior vertebræ simple. Mandible with opercular and coronoid. Maxillary not transversely segmented, bordering the month. Third superior pharyngeal lying on enlarged fourth. Upper basihyal wanting. Vertebræ amphicœlian. Pectoral fins with mesopterygium and eight other elements.

This order includes only the family of Amiida. (Latin halecomorphus, formed like a shad; in allusion to the resemblance between this group of Ganoids and the *Isospondyli*.)

## FAMILY XXVIII.—AMIIDÆ.

(The Mud-fishes.)

Body oblong, compressed behind, terete anteriorly. Head subconical, anteriorly bluntish, slightly depressed, its superficial bones corrugated

and very hard, scarcely covered by skin. Snout short, rounded. eral margins of upper jaw formed by the maxillaries, which are divided by a longitudinal suture. Jaws nearly even in front. Cleft of the month nearly horizontal, extending beyond the small eye. Lower jaw broad, U-shaped, the rami well separated. Between them a broad bony plate, with radiating strice, its posterior edge free. Jaws each with an onter series of conical teeth, behind which in the lower is a band of rasp-like teeth. Bands of small teeth on the vomer and pterygoids. Palatines with a series of larger, pointed teeth. Premaxillaries not protractile. Tongue thick, scarcely free at tip. Nostrils well separated, the anterior with a short barbel. Suborbital very narrow. A bouy plate covering the cheek, similar to the plates on the top of the head. Operculum with a broad dermal border. Branchiostegals 10-12. No pseudobranchiæ nor opercular gill. No spiracle. Gills 4, a slit behind the fourth. Gill membranes not connected, free from the isthmus. Two peculiar, long, lanceolate, obliquely striate appendages on each side of the isthmus, projecting backward and covered by the branchiostegal rays, the anterior wholly adnate to the isthmus, the posterior free behind.\* Isthmus scaleless. Gill-rakers stoutish, very short. Scales of moderate size, rather firm, cycloid, with a membranaceous border. Lateral line present. Dorsal fin long and low, nearly uniform; the posterior rays not much higher than the others; its insertion in front of the middle line of the body, opposite the end of the pectoral. Tail somewhat heterocercal (more so in the young), convex behind. No fulera. Anal fin short and low. Pectoral and ventral fins short and rounded, the ventrals nearer anal than pectorals. Vertebræ amphicælian, as usual among fishes. Abdominal and caudal parts of the vertebral column subequal. Air-bladder cellular, bifid in front, lung-like, connected by a glottis with the pharynx, and capable of assisting in respiration. Stomach with a blind sac; no pyloric cœca. No closed oviduct. Intestine with a rudimentary spiral valve. Fresh waters of the United States. A single species known.

<sup>\*</sup>See Wilder "On the Serrated Appendages of the Throat of Amia," Proc. Amer. Assoc. Adv. Sci. 1876, 259, for a discussion of these curious organs.

#### 51 .- AMIA Linnæus.

### Bow-fins.

(Amiatus Rafinesque.)

(Linn. Syst. Nat. ed. xii, 1766: type Amia calva L.)

Characters of the genus included above. (à $\mu$ ia, ancient name of some fish, probably the bonito, Sarda mediterranea; said to be from a, privative, and  $\mu$ ia, one, the fish living in schools.)

B3. A. eniva L.—Mud-fish; Dog-fish; Bow-fin; Grindle; "John A. Grindle"; Lawyer.

Dark olive or blackish above, paler below; sides with traces of dark reticulate markings; lower jaw and gular plate often with round blackish spots. Fins mostly dark, somewhat mottled. Male with a round black spot at base of caudal above, this surrounded by an orange or yellowish shade. In the female this spot is wanting. Lateral line nearly median, directed slightly upward at each end. D. 48 (42–53); A. 10–12; V. 7; Lat. l. 67 (65–70). Head 3\frac{3}{4} in length; depth 4 to 4\frac{1}{2}. Male about 18 inches in length; female 24 or more. Great Lakes and sluggish waters from Minnesota to Virginia, Florida, and Texas; abundant. A voracious fish of remarkable tenacity of life. The flesh is peculiarly soft and pasty, and is of no value for food.

(Linn. Syst. Nat.; Günther, vii, 325: Amia occilicanda Richardson, Fauna Bor.-Amer. iii, 236 (3): Amia occidentalis Dekay, New York Fauna, Fish. 269.)

## SUBCLASS PHYSOSTOMI.

(The Soft-rayed Fishes.)

Skeleton bony. Ventral fins (if present) abdominal, with the basal segments rudimental. Parietal bones usually united. Air-bladder (if present) connected by an air-duct with the æsophagus. Scales mostly cycloid. Lateral line usually running low. Parietal bones usually united. Præcoracoid generally present. Rays of fins all soft and articulated, except occasionally one or two of the anterior rays of any fin, which may be spinous. Lateral margins of upper jaw usually formed by the maxillaries. Pectoral fin placed low, generally near the ventral line.

This group corresponds essentially to the *Malacopteri Abdominales* of different authors, the *Cycloidei* of Professor Agassiz. Although the typical members of this group differ in many ways from the more special-

ized Physoclistous Teliosts, yet all the subordinate characters disappear as we approach the point of union of the two groups, leaving only the presence of the air-duct as the ultimate distinctive character of the *Physostomi*. In view of this inosculation of the two groups, many writers (following Professor Gill) have united them both into one order, *Teleocephali*, after the exclusion of various aberrant members of each. The retention, in some form, of groups emphasizing the difference between the spinous and the soft-rayed fishes seems to us very convenient. (Order *Physostomi* Günther, y-viii.)

#### ANALYSIS OF ORDERS OF PHYSOSTOML\*

A. Præcoracoid arch present.

B. Symplectic bone none; pterotic simple; anterior vertebræ with ossicula auditus; supraoccipital and parietals co-ossified; maxillary imperfect, forming the base of a barbel; no suboperculum..Nematognath, K. BB. Symplectic bone present.

C. Anterior vertebræ co-ossified and with ossicula auditus.

Plectospondyli, L.

CC. Anterior vertebræ similar, distinct, without ossicula auditus.

Isospondyli, M.

AA. Præcoracoid arch none.

D. Scapular arch suspended to cranium; a symplectic bone; pterotic and anterior vertebræ simple; parietals separated by supraoccipital.

HAPLOMI, N.

DD. Scapular arch free behind the eranium; parietals in contact; no symplectic; maxillary bone lost or connate....Encuelycephali, O.

## ORDER K.—NEMATOGNATHI.

(The Cat-fishes.)

Parietals and supraoccipital confluent. Four anterior vertebræ coossified, and with ossicula auditus. No mesopterygium. Basis cranii and pterotic bone simple; no coronoid bone. Third superior pharyngeal bone wanting, or small and resting on the fourth; second directed backwards. One or two pairs of basal branchihyals; two pairs branchihyals. Suboperculum wanting. Premaxillary forming mouth border above. Interclavicles present. No scales. Skin naked or with bony plates.

"This division is the nearest ally to the sturgeons (*Chondrostei*) among Physostomous fishes, and I imagine that future discoveries will prove that it has been derived from that division by descent. In the same

<sup>\*</sup> After Cope, Trans. Amer. Phil. Soc. 1870, 452.

way the Isospondylous fishes are nearest the *Halcomorphi*, and have probably descended from some Crossopterygian, near the *Haplistia*, through that order. The affinity of the eat-fishes to the sturgeons is seen in the absence of symplectic, the rudimental maxillary bone, and, as observed by Parker, in the interclavicles. There is a superficial resemblance in the dermal bones." (*Cope.* 1. e., 454.)

This group comprises the *Siluridæ* and their relatives, now divided into several families by Professor Gill. ( $\nu \tilde{\eta} \mu a$ , thread;  $\gamma \nu \dot{a} \theta \sigma \varsigma$ , jaw; from the maxillary barbels, which are always present.)

ANALYSIS OF THE FAMILIES OF NEMATOGNATHI.

\*Operculum present; dorsal fin, if present, short, anteriorly placed. . Siluridæ, 29.

## FAMILY XXIX.—SILURIDÆ.

(The Cat-fishes.)

Body more or less elongate, naked or covered with bony plates. No true scales. Anterior part of head with two or more barbels, the base of the longest pair formed by the rudimentary maxillary. Margin of upper jaw formed by premaxillaries only. Suboperculum absent; operculum present. Dorsal fin usually present, short, above or in front of the ventrals. An adipose fin usually present. Anterior rays of dorsal and pectorals usually spinous. Air-bladder usually present, large, and connected with the organ of hearing by means of the auditory ossicles. Lower pharyngeals separate.

After the removal of numerous aberrant forms as distinct families, the family of *Siluridæ*, as understood by Professor Gill, contains more than 100 genera and upward of 900 species. Most of the *Siluridæ* are fresh-water fishes, inhabiting the rivers of warm regions, particularly South America and Africa. Comparatively few of them are marine, and these few are mostly tropical.

Our species all belong to the division called by Dr. Günther, Siluridæ Proteropteræ, and thus characterized:

"The rayed dorsal is always present, short, with not more than 12 soft rays, and belongs to the abdominal portion of the vertebral column, being placed in advance of the ventrals. The adipose fin is always present and well developed, although frequently short. The extent of the anal is much inferior to that of the caudal vertebral column. The gill membranes are not confluent with the skin of the isthmus, their

posterior margins always free, even if they are united with each other. Whenever a nasal barbel is present it belongs to the posterior nostril."

(Silurida part Günther, v, 30-65, 69-220: Heteroptera, Proteroptera, and Stenobranchia.)

- \* Anterior and posterior nostrils remote from each other, the posterior provided with a barbel; vomer and palatines toothless; barbels 8. (Ictalurium.)
  - a. Adipose fin keel-like, adnate to the back; supraoccipital bone free behind.

    NOTURUS, 52.
  - aa. Adipose fin with its posterior margin free.

    - bb. Premaxillary band of teeth truncate behind.
      - c. Candal not forked.
        - d. Eyes concealed beneath the skin .... Gronias, 54.
- \*\* Anterior and posterior nostrils close together, neither with a barbel, the posterior with a valve; teeth on the palate. (Ariinw.)

#### 52.-NOTURUS Rafinesque.

#### Stone Cats.

(Noturus Raf. Amer. Month. Mag. and Crit. Rev. iv, Nov. 1818, 41: type Noturus flarus Rafinesque.)

Body more or less clougate, anteriorly subcylindrical, thence more or less compressed. Head above ovate and depressed. Skin very thick, entirely concealing the bones. Supraoccipital entirely free from the head of the second interspinal. Eyes small. Mouth anterior, rather large, the upper jaw usually more or less projecting beyond the lower. Teeth subulate, closely aggregated in a broad band in each jaw, which in the lower one is interrupted by a linear interval and in the upper one is continuous. The band in the upper jaw is either abruptly truncated at each end (subgenus Schilbcodes) or prolonged backward by a continnation from the postero-external angle (subgenus Noturus). Branchiostegals 9. Dorsal fin situated over the posterior half of the interval between the pectoral and ventral fins, with a short, sharp spine and 7 branched rays. Adipose fin long and low, more or less connected with the accessory rays of the caudal fin, not free posteriorly, but adnate to the body; the membrane sometimes high and continuous, sometimes notched. Candal fin very obliquely truncated or rounded, inserted on an equally obliquely rounded base. Rays rapidly decreasing in length inferiorly; numerous rudimentary ones present, both above

Bull. Nat. Mus. No. 16——7

and below the candal peduncle. Anal fin comparatively short, and rapidly increasing in height for the first half of its length; it has 12–20\* rays. Ventrals rounded, and each has 1 simple and 8 branched rays. Pectoral fins with a sharp spine, of different forms in the different species. Vent at some distance in advance of the anal. Lateral line complete. In or above the axil of the pectoral fins is an orifice, which is the opening of the duct of a poison gland. "From it may frequently be drawn a solid gelatinous style ending in a tripod, each limb of which is dichotomously divided into short branches of regular length." (Cope.) Size small. Fresh waters of the United States. (võros, back; δυρὰ, tail; "means tail over the back", Rafinesque.)

- \* Premaxillary band of teeth without lateral backward processes. (Schilbeodes† Bleeker.)
  - +Pectoral spine entire or grooved behind; adipose fin high and continuous with the caudal.
    - a. Pectoral spine about half the length of the head.

#### 84. N. gyrimus (Mitchill) Raf.

Nearly uniform yellowish brown, sometimes blackish, without transverse blotches; a narrow dark lateral streak and one or more dorsal ones. Body comparatively short and thick. Head large, its width  $3\frac{1}{2}$ – $4\frac{1}{2}$  in length of body; depth 4– $5\frac{1}{2}$ ; head  $3\frac{1}{2}$ –4. Spines stout and rather long; that of the pectoral fin straight, grooved behind,  $2\frac{1}{3}$  in the distance from snout to dorsal fin. Dorsal higher than long, inserted nearer anal than snout. Anal 13. Jaws nearly equal. Humeral process short. L. 5 inches. New York, entire Mississippi Valley, and Upper Lake region; rather common.

(Silarus gyrinus Mitchill, Amer. Month. Mag. 1818, 322; Jordan, Bull. U. S. Nat. Mus. x, 102: Noturus sialis Jordan, Bull. U. S. Nat. Mus. x, 102, 1877.)

aa. Pectoral spine less than one-third the length of the head.

## 85. N. leptacanthus Jordan.

Color yellowish, somewhat mottled. Body slender. Head small and narrow, longer than broad. Eye small. Upper jaw much projecting. Spines very short and slender; that of the dorsal not one-third the height of the fin; all less than one-third the length of the head; that of the pectoral retrorsely serrate on the outer edge, entire within. Head  $4\frac{4}{5}$  in body; its width  $5\frac{1}{2}$ ; depth  $5\frac{1}{2}$ ; distance to dorsal  $2\frac{4}{5}$ ; pectoral spine

<sup>\*</sup>Throughout the account of this family the rudimentary rays at the front of the anal are included in the enumeration.

<sup>†</sup> Bleeker, Ichthyologiæ Archipelagi Indiei Prodromus, i, Siluri, 258: type Silurus gyrinus Mitch. (Schilbe, another genus of Siluridæ; ειδος, like.)

5 in this distance; dorsal nearer anal than snout. Anal 14. Humeral process very short. L.3 inches. Georgia to Mississippi; not abundant.

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1877; Jordan, l. c. 102.)

- the Pectoral spine serrate behind, roughish in front; adipose fin emarginate.
  - bb. Pectoral spines extremely strong, more than half the length of head, curved; their posterior serrae strong, spine-like, hooked backward, each about as long as the diameter of the spines.

#### 86. N. mittres Jordan.

Body much mottled, black and grayish. Top of head, tip of dorsal, middle of adipose fin, and edge of candal definitely blackish. Body with four broad cross-blotches, one before dorsal, one behind it, one on middle of adipose fin, and one small one behind it. Adipose fin connected with the caudal fin. Distance from snout to dorsal about 2\frac{3}{3} in length. Pectoral spine 2\frac{1}{3} in this distance. Dorsal fin higher than long. Body not very elongate nor much depressed. Dorsal region often somewhat elevated. Depth usually 4\frac{1}{2}-5 in length; head 3\frac{3}{4}-4. Dorsal nearer anal than tip of snout. Anal 12 or 13 rays. Pectoral spine curved and finely serrate without, with six strong recurved pectinations within, each nearly as long as the diameter of the spine. Humeral process short. L. 4 inches. Great Lakes to Minnesota and Louisiana; common.

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1877, 371; Jordan, l. c. 100.)

#### 87. N. eleutherus Jordan.

Color much as in N. miurus, extensively variegated. Snout, cheeks, and occipital region black. A black bar across front of dorsal, one behind dorsal, and another across middle of adipose fin; base of caudal fin black. One or two narrow horizontal black bars across dorsal and anal near their tips. Caudal vaguely barred, largely black, its tip white. Body stout, broad forward, tapering behind. Head large, flattish,  $3^3$  in length of body, without caudal; depth of body  $5^4$  in length; width of head 41 in length of body. Mouth large, the upper jaw much projecting; barbels rather long. Adipose fin rather high, so deeply notched that the continuity of the fin is broken for a distance nearly equal to the diameter of the eye. A keel on the back in front of the adipose fin. Caudal fin rounded. Distance from snout to dorsal 23 in length of body. Pectoral spine in this distance 2 times; in head 14. Dorsal spine one-half the height of the fin; 3\frac{1}{3} times in distance from snout to dorsal; 23 in length of head. Pectinations of pectoral spine very strong, recurved, nearly as long as the diameter of the spine. Front of pectoral spine with small teeth turned forward. Fin-radii: D. I, 6; A. 13; P. I, 8; V. 9. Humeral process long. L. 5 inches. Rivers of North Carolina and East Tennessee.

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1877, 371; Jordan, I. c. 101.)

bb. Pectoral spines shortish, nearly straight, less than half length of head; the serratures weak, less than half the diameter of the spine; body clongated.

#### 88. N. exitis Nelson.

Color brown, mottled, the fins somewhat margined with dusky. Pectoral spine slightly retrorse-serrate without, with about 6 small straight teeth within, which are not one-third the diameter of the spine in length. Head small, not very broad, but thin and depressed; its width 5-6 in length of body; jaws nearly equal; head 4 in length, depth 5-6½. Dorsal scarcely higher than long. Distance from snout to dorsal about 3 in length. Pectoral spine 3½-4 in this distance; dorsal spine low, as near snout as anal. Anal rays 14-17. Humeral process obscure. L. 4 inches. Wisconsin to Missouri and Kansas.

(Nelson, Bull. Ill. Mus. Nat. Hist. 1876, 51; Jordan, l. c. 100.)

## 89. N. imsigmis (Rich.) Gill & Jordan.

Color dark brown, somewhat mottled, fins all dark-edged. Body rather elongate. Pectoral spine retrorse-serrate without, weakly serrate within. Head very broad, flat, and thin, upper jaw projecting; head about  $4\frac{1}{4}$  in length, depth 6. Dorsal fin one-fourth higher than long. Distance from snout to dorsal about  $2\frac{3}{4}$  in length. Length of pectoral spine  $2\frac{3}{4}$  in same distance. Dorsal much nearer anal than snout. Anal rays 16–20. Humeral process conspicuous, sharp. Size large; reaches the length of nearly a foot. Pennsylvania to South Carolina; common.

(Pimelodus insigue Richardsou, Fauna Bor.-Amer. iii, 32, 1836, based on Pimelode livrée Le Sueur, Mém. Mus. v, 155: Pimelodus lemniscatus C. & V. xv, 144: Noturus occidentalis Giinther, v, 105: Noturus marginatus (Baird) Cope, Journ. Acad. Nat. Sci. Phila. 1869, 237; Jordan, l. c. 100.)

\*\*Premaxillary band of teeth with lateral backward processes, as in *Pilodictis*. (Noturus.)

#### 90. N. flavus Raf.-Stone-cat.

Color nearly uniform yellowish brown, sometimes blackish above, fins yellow-edged. Body elongate. Head depressed, broad and flat, nearly as broad as long. Middle region of body subcylindrical. Tail compressed. Head about  $4\frac{1}{4}$  in length; width of head  $5\frac{1}{3}$ ; depth  $5\frac{1}{3}$  in length. Distance to dorsal about 3 in length. Barbels short. A strong keel on back behind dorsal, leading to adipose fin; adipose fin deeply notched. Dorsal spine very short. Pectoral spine retrorsely serrate in

front, slightly rough or nearly entire behind; its length 3 times in distance from snont to dorsal. Anal rays about 16. Humeral process very short and sharp. Size very large; reaches a length of more than a foot. Vermout to Virginia, Nebraska, and Texas; rather common.

(Rafinesque, Amer. Month. Mag. 1818, 41; Günther, v. 101; Jordan, l. c. 99; Noturus occidentalis Gill, Proc. Bost. Soc. Nat. Hist. 1832, 45; Noturus platycephalus Günther, v. 104.)

#### 53.—PILODICTIS Rafinesque.

#### Mud Cats.

(Opladelus Raf. 1820.)

(Rafinesque, Prodrome de soixante-dix nouveaux genres, etc., Journ. Phys. Paris, 1819, 422: type Pilodictis limosus Raf. = Silurus olivaris Raf.)

Body much elongated, very slender, much depressed, anteriorly broader than high. Head large, very wide and depressed, latterly expanded, above broadly ovate, and in profile cunciform. Skin very thick, entirely concealing the skull. Supraoccipital bone entirely free from the head of the second interspinal. Eyes small. Mouth very large, anterior and transverse. The lower jaw always projects beyond the upper. Teeth in broad villiform bands on the intermaxillaries and dentaries. The intermaxillary band is convex anteriorly, and proceeds to the insertion of the maxillaries, where it is abruptly angularly defleeted, and proceeds backward as an elongated triangular extension. The band at the symphysis is slightly divided, and anteriorly separated by a small triangular extension of the labial membrane. The lower band of teeth is anteriorly semicircular and attenuated to the corners of the mouth. There are about 12 branchiostegal rays on each side. The dorsal fin is situated over the posterior half of the interval between the pectorals and ventrals, and has a spine and about 7 branched rays. The spine is rather small, and more or less enveloped in the thick skin. The adipose fin is large, and has an elongated base resting over the posterior half of the anal; it is very obese and inclines rapidly backward; it is rather less free posteriorly than in Amiurus. The anal fin is small; it commences far behind the anns, is a little longer than high, and is composed of about 13 rays. The candal fin is oblong, subtruncated, placed on a vertical basis, and with numerous accessory simple rays, recurrent above and beneath the candal peduncle. The pectorals have a broad compressed spine, serrated or dentated on its external and internal margins, and with a prolonged fleshy integument obliquely striated. The ventrals are rounded and have 9 rays, 1 simple and 8 branched. One species known. (πελός, mud; ἐχθὸς, fish.)

### 91. P. Olivaris (Raf.) Gill & Jordan.—Mud Cat; Yellow Cat; Bashaw; Goujon.

Mottled brown and yellowish, the latter color often predominant; whitish below. Body very long, slender, depressed forwards, closely compressed behind, the head extremely flat, the lower jaw the longer. Barbels short. Dorsal spine half the height of the fin. Caudal slightly emarginate. Anal fin short, its base about one-sixth the length, its rays 12–15. Humeral process short. Size very large, reaching a weight of 50–75 pounds. Rivers of the Mississippi Valley and Southern States; abundant in deep, sluggish waters. A fish of unprepossessing appearance, although much used as food.

(Siluvus olivaris Raf. Amer. Month. Mag. 1818, 355: Hopladelus olivaris Gill, Ichth. Capt. Simpson's Expl. 1876, 426: Pelodichthys olivaris Jordan, l. c. 95: Pimelodus punctulatus Günther, v, 101: Pimelodus limosus Raf. Ichth. Oh. 67: Pimelodus æneus C. & V. xv, 135.)

#### 54.-GRONIAS Cope.

#### Blind Cats.

(Cope, Proc. Acad. Nat. Sci. Phila. 1864, 231: type Gronias nigrilabris Cope.)

This genus agrees with Amiurus in all respects, except that the eyes are rudimentary and covered by the thick skin. The single species is probably descended from some Amiurus of the type of melas, modified in accordance with its subterranean life. ( $\gamma \rho \dot{\omega} \gamma_{\eta}$ , a cavern.)

#### 92. G. migrilabris Cope.

Black above; jaws and fins black; sides varied with yellowish; belly pale. Eyes more or less rudimentary and concealed beneath the skin. Jaws equal. Muzzle flat. Dorsal spine midway between snout and middle of adipose fin. Barbels short. Caudal slightly emarginate. Anal with 18 rays. Branchiostegals 10. Cave streams (Conestoga River), Eastern Pennsylvania.

(Cope, Proc. Acad. Nat. Sci. Phila. 1834, 231: Amiurus nigrilabris Jordan, l. c. 92.)

## 55.—AMIURUS Rafinesque.

## Cat-fishes.

(Ameiurus Rafinesque, Ichth. Oh. 1820, 65: type Silurus cupreus Raf. = Pimelodus natalis Le Sueur.)

Body moderately elongated, robust, anteriorly vertically ovate and scarcely compressed; candal peduncle also robust, but much compressed, and at its end evenly convex. Head large, wide, laterally expanded, above ovate, and in profile cuneiform; supraoccipital extended little posteriorly and terminating in a more or less acute point, which is entirely separate from the second interspinal buckler; the skin covering

the bones is thick. Eyes rather small, not covered by the skin. Mouth large, terminal, transverse, the upper jaw in most species the longer. Teeth subulate, aggregated in broad bands on the intermaxillaries and dentaries: the intermaxillary band is convex in front, of equal breadth. and abruptly truncated near the insertion of the intermaxillaries; the lower dental band is anteriorly semicircular, attenuated to the angles of the month. Branchiostegal rays 8-11. Dorsal situated over the interval between the pectorals and ventrals, higher than long, with a pungent spine and about 6 branched rays. Adipose fin short, inserted over the posterior half of the anal. Anal fin varying length, with 15-35 rays, the usual number being 20 or 21. Caudal fin short, usually truncate when spread open, slightly emarginate when not expanded. Ventrals each with 1 simple and 7 branched rays. Pectoral fins each with a stout spine, which is commonly retrorse-serrate behind. Lateral line usually incomplete. Species very numerous, swarming in every pond and sluggish stream in the Eastern United States; one species (A. cantonensis) in China. (a. privative: μείουρος, curtailed; the caudal fin not notched.)

- \* Caudal fin not forked, rounded or slightly emarginate.
  - a. Anal fin very short, its rays 15-17 (18).
    - b. Body comparatively long and slender.

#### 93. A. brunnens Jordan.-Green Mud Cat.

Clear olive-brown, more distinctly greenish than other cat-fishes; a blackish horizontal bar at base of dorsal. Body extremely elongate; anteriorly nearly terete. Head low, flat, and broad, upper jaw very strongly projecting. Dorsal fin very high, two-thirds length of head, its spine nearer snout than adipose fin; depth  $5\frac{1}{2}$  in length. Head  $3\frac{1}{2}$ ; its width 4; base of anal 6; anal rays 16–18. Caudal slightly emarginate. Young much less elongate. L. 18 inches; slenderest of the Amiuri. Abundant in the streams of South Carolina and Eastern Georgia (Santee to the Chattahoochee).

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1877, 366; Jordan, l. c. 93; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 28.)

- aa. Anal fin moderate, its rays 19-22.
  - c. Lower jaw not projecting beyond upper.

#### 94. A. platycephalus (Grd.) Gill.

Olivaceons, somewhat marbled, a black horizontal bar at base of dorsal. Head broad and flat, nearly as wide as long. Mouth very wide, the jaws about equal. Dorsal spine nearer snout than adipose fin. B. 11; A. 20-22, the base of the fin 4½-5 in length. North Carolina to

Georgia; rather common. Resembles A. brunneus, but less sleuder and with a different month.

(Pimelodus platycephalus Girard, Proc. Acad. Nat. Sci. Phila. 1859, 161; Jordan, l. c. 93.)

### 95. A. xanthocephalus (Raf.) Gill.

Chiefly uniform yellowish brown, often rather pale. Head about as broad as long, 4 in length. Dorsal spine nearer adipose fin than snout, its rays usually 19 (18–20). Month very broad. Body short and stout. Barbels shorter than head. Humeral process very short, covered by skin. Size small. Ohio Valley.

(Silurus xanthocephalus Raf. Quart. Journ. Sci. Lit. Arts, Lond. 1820, 51; Jordan, l. c. 42.)

### 96. A. melas (Raf.) Jordan & Copeland.—Bull-head.

Color almost black. Body very stout, short, and deep, the depth 3½ to 4¼ in length. Head broad behind, rather contracted forward, the front steeply elevated. Anal fin short and deep, of 17–19 rays, its base nearly 5 in length, the color of the rays forming a sharp contrast with that of the dusky membranes. Jaws nearly equal. Barbels longer than head. Humeral process rather long, rugose. Size small. Mississippi Valley to New York; common.

(Silurus melas Raf. Quart. Journ. Sci. Lit. Arts, Lond. 1820, 51: Pimelodus catulus Grd. Ichth. U. S. Pac. R. R. Surv. 1858, 208: Pimelodus confinis Grd. Proc. Acad. Nat. Sci. Phila. 1859, 159: Amiurus obesus Gill, Proc. Bost. Soc. Nat. Hist. 1832, 45; Jordan, I. c. 89: Pimelodus pullus DeKay, New York Fauna, Fish. 184: Amiurus pullus Jordan, I. c. 93.)

#### 97. A. marmoratus (Holbrook) Jordan.

Body sharply mottled with brown, greenish, and whitish; the coloration therefore singular among cat-fishes. Jaws equal, or nearly so; depth about 4 in length; slope of profile very steep. Dorsal fin high; the spine more than half length of head. Dorsal spine nearer adipose fin than snout. Barbels long. Branchiestegals 10. Head 3½ in length. Anal 21. L. 15 inches. Southern Illinois to Florida. Perhaps a variety of A. catus.

 $(Pimrlodus\ marmoratus\ Holbrook,\ Journ.\ Acad.\ Nat.\ Sci.\ Phila.\ 1855, 54:\ Jordan,\ l.\ c.\ 89.)$ 

# 98. A. cratus (Linn.) Gill.—Bull-head; Horned Pout; Small Cat-fish; Schuylkill Cat; Sacramenio Cat.

Color dark yellowish brown, more or less clouded, sometimes yellowish, sometimes nearly black. Body rather elongate; depth 4-4½ in length. Anal fin usually with 21 or 22 rays, its base 4 in body. Dorsal fin inserted rather nearer adipose fin than end of shout. Upper jaw usually distinctly longer than lower. Humeral process more than half

the length of pectoral spine. L. 18 inches. Great Lakes, Ohio Valley, and eastward. The common bull-head or horned pout of the North and East, abundant in every pond and stream; also introduced into the rivers of California, where it has rapidly multiplied.

(? Silurus catus Linn. Syst. Nat. x, 305, 1758; Pimelodus nebulosus Le Suenr, Mém. Mus. v, 149, 1819; Pimelodus otrarius DeKay, New York Fauna, Fish. 1842, 185; Jordan, L. c. 90.)

cc. Lower jaw projecting beyond upper.

#### 99. A. vulgaris (Thompson) Nelson.

Dark reddish brown or blackish. Body moderately elongate; depth 4½-5 in length. Head 3½-4. Barbel long. Mouth wide. Head longer than broad, rather narrowed forward. Profile rather steep, pretty evenly convex. Dorsal region more or less elevated. Lower jaw strongly projecting. Anal rays 20. L. 18 inches. Vermont to Minnesota and southward; rather common.

(Pimelodus vulgaris Thompson, Hist. Vermont, 1842, 133: Pimelodus dekayi Girard, Proc. Acad. Nat. Sci. Phila. 1859, 160: Pimelodus ailurus Girard, U. S. Pac. R. R. Expl. Fish. 1858, 210; Jordan, I. c. 88.)

aav. Anal fin long, of 24-27 rays, its base more than one-fourth the length.d: Head broad: mouth wide.

### 100. A. matalis (Le Sueur) Jordan.-Fellow Cat.

Yellowish, greenish, or blackish. Body more or less short and chubby, sometimes extremely obese (var. natalis), sometimes more elongate (var. lividus). Head short and broad. Mouth wide, the jaws equal (var. lividus) or the upper jaw longest (var cupreus). Anal rays 24-27. Great Lake region to Virginia and Texas; generally abundant. Extremely variable, and running into several varieties.\*

(Pimelodus natalis Le Sueur, Mém. Mus. v, 154, 1819; Giinther, v, 101; Jordan, l. c. 86: Silurus lividus Rafinesque, Ichth. Oh. 1820, 65: Pimelodus feliuus et antonicusis Grd. U. S. Pac. R. R. Expl. x, 209, 291: Pimelodus catus, cupreus, et cupreoides Grd. Proc. Acad. Nat. Sci. Phila. 1859, 159, 160: Pimelodus canosus Richardson, Fauna Bor.-Amer. iii, 132: Pimelodus cupreus Raf. Ichth. Oh. 1820, 65.)

dd. Head elongate; mouth narrow.

#### 101. A. erebemmus Jordan.

Color black; belly paler; fins and barbels black. Body rather elongate, compressed, the depth about 4\forall in length. Dorsal region rather elevated; the head quite long and narrowed forward, 4 times in length of body. Head more narrowed than in any of the other species. Width of the head in front of the eye but little more than half its length. Width of the month about half the length of the head.

<sup>\*</sup> For a discussion of which see Jordan, Bull. U. N. Nat. Mus. x, 86.

Greatest width of the head contained about  $1\frac{1}{3}$  times in its length. Dorsal fin slightly nearer the snout than the adipose fin, unusually high, its spine leng, as in the species of *Ictalurus*. Pectoral spine very strong, about helf as long as the head. Anal fin long, deep, nearly one-third the length of the body, and composed of 24 rays. Adipose fin large. Caudal fin rather short, truncate behind. Jaws equal. Supra-occipital bone but little free behind. Branchial apertures rather more restricted than usual. Resembles *I. lacustris*, but with the truncate caudal of *A. natalis*. Rivers of Florida.

(Jordan, Bull. U. S. Nat. Mus. x, 85.)

### 56.—ICTALURUS Rafinesque.

#### Channel Cats.

(Rafinesque, Ichth, Oh. 1820, 61: type Silurus punctatus Ráfinesque.)

Body elongated, slender, and much compressed. Head usually slender and conical. The supraoccipital bone is prolonged backward, and its emarginated apex, in typical species, receives the acuminate anterior point of the second interspinal, thus forming a continuous bony bridge from the head to the dorsal spine. In some species, this connection is more or less imperfect, as in Amiurus, to which genus all such species have been hitherto referred. Mouth transverse and terminal, the upper jaw protruding beyond the lower. Teeth subulate, aggregated into a short, laterally truncated band on each jaw. Branchiostegal rays 8 or Dorsal fin situated over the interval between the pectoral and ventral fins, higher than long, with one long spine, and usually 6 articulated rays. Adipose fin pedanculated, over the posterior portion of the anal. Anal fin long, with 20-35 rays; it commences near the vent. Ventral fins each with 1 simple and 7 branched rays. Pectoral fins each with a stout spine, retrorse-serrate within, and about 9 branched rays. fin elongated and deeply forked, with the lobes pointed, the upper frequently the longer. Coloration silvery. Fresh waters of North America, one species southward to Guatemala;\* one in Western Mexico.†

<sup>\*</sup>I. meridionalis (Günther) Jordan. Allied to I. furcatus, but the anal shorter, the depth 5 in length. A. 28-29. Rio Usumacinta, Guatemala. (Amiurus meridionalis Günther, v, 102.)

tI. dugesi (Bean) J. & G. Closely allied to I. albidus, but with a narrower head (its width 5 in length); the width of the premaxillary band of teeth about one-third the length of the head; humeral process slightly furrowed, not strongly rugose as in I. albidus. Candal deeply forked. Color plumbeous, silvery below. B. 8; D. 1, 6; A. 21; P. I, 8. Rio Turbio, Guanajuato, Mexico (west of the Sierra Madre). (Amiurus dugesi Bean, Proc. U. S. Nat. Mus. ii, 304, 1879.)

( $i\chi\theta\delta\epsilon$ , fish;  $ai\lambda\sigma\sigma\rho\sigma\epsilon$ , eat; hence more correctly, though less euphoniously, *Ichthælurus*.)

ø. Bony bridge from occipnt to dorsal not quite continuous.
 b. Anal fin moderate, of 20-22 rays.

#### 102. I. lophius (Cope) J. & G.

Pale olive-bluish, silvery below. Body rather stout. Head very broad, about as wide as long, its width  $3\frac{3}{4}$  in length of the body. Eye 5-6 in interorbital width. Caudal not deeply forked. Upper jaw not much the longer. Month wider than in any other cat-fish. Humeral process stout, shortish, somewhat rugose. Anal rays 21; base of anal 6 in length. L. 24 inches. Streams about Chesapeake Bay.

(Amiurus lophius Cope, Proc. Amer. Phil. Soc. 1870, 483: Amiurus lophius Jordan, l. c. 85.)

# 103. I. albidus (Le Sueur) J. & G.-White Cat: Channel Cat of the Potomac.

Pale olive-bluish, silvery below. Body moderately stout. Head longer than wide, its width 4–6 times in length. Mouth rather narrow. Upper jaw much the longer. Eye 3–5 in interorbital width. Barbels long, except nasal barbel. Candal fin deeply forked, the upper lobe the longer. Humeral process more than half the length of the spine, extremely rugose. Anal rays 21; base of anal 4½–5 in length. Dorsal fin nearly midway between adipose fin and snout. L. 18 inches. Pennsylvania to North Carolina.

(Pimelodus albidus Le Sneur, Mém. Mus. v, 148, 1819: Pimelodus lynx Girard, Proc. Acad. Nat. Sci. Phila. 1859, 160: Amineus albidus Jordan, l. c. 84.)

bb. Anal fin long, of 23-27 rays.

#### 104. I. lupus (Grd.) J. & G.

Dusky olivaceous, sides silvery. Body rather slender. Head narrow, longer than broad, its width  $4\frac{3}{4}$  in length, being less than its length above. Dorsal spine much nearer snout than adipose fin. Base of anal as long as head. Anal 23. Pectoral spines long and slender, dentate. Barbels long. Supraoccipital bone almost meeting the interspinal; its relations therefore very close to *Ictalurus punctatus*. Streams of Texas.

(Pimelodus lupus Grd. U. S. Pac. R. R. Expl. x, 211: Amiurus lupus Jordan, l. c. 83: Amiurus lupus Günther, v, 101.)

## 105. I. niveiventris (Cope) J. & G.

Similar to *I. lupus*, but the head broader, its width equal to its length above. Dorsal spine scarcely nearer shout than adipose fin. Anal 24, shorter than head. Barbel longer than head; humeral process very rugose. Neuse River, North Carolina.

(Amiurus niveiventris Cope, Proc. Amer. Phil. Soc. 1870, 486: Amiurus niveiventris Jordan, I. c. 83.)

106. I. Recustris (Walbaum) J. & G.—Cat-fish of the Lakes; Great Fork-toiled Cat; Mississippi Cat; Florida Cat; Flaunel-month Cat.

Olivaceous slaty, growing darker with age; sides pale, without dark spots; anal dusky edged. Body rather stonter than in I. munctatus. Head much broader, lower, and more depressed than in I. nunctatus. its greatest width five-sixths its length. Interorbital space somewhat more than half the length of head. Width of the mouth about half head. Eye moderate, wholly in front of middle point of head. Top of head covered with a thicker skin than in punctatus, so that the bones are nearly concealed. Upper surface of head onite flattish, so that the eyes are much nearer the upper than the lower surface of the head. Barbels long, all black, the maxillary barbel reaching beyond head. Humeral process very short and blunt, covered by skin, a little more than one-third the length of the pectoral spine. Caudal deeply forked. the upper lobe rather longer and narrower than the lower. Dorsal a little nearer snout than adipose fin. Head 4 in length; depth 5. Distance to dorsal spine 23. Anal base as long as head. D. I, 5; P. I, 9; A. 25. British America to Florida and Texas; abundant in all large bodies of water. One of the largest of the cat-fishes, reaching a weight of 100 pounds.

(? Gadus lacustris Walbaum, Artedi Pisc. 1792, 144: ? Pimelodus borealis Richardson, Fauna Bor.-Amer. Fish. 135: ? Amiurus borealis Günther, v, 100: Pimelodus uigricans Le Sueur, Mém. Mus. v, 153, 1819: Amiurus nigricans Jordan, l. c. 83: Amiurus borealis Jordan, l. c. 84.)

bbb. Anal fin very long, of 35 rays.

# 107. I. ponderosus (Bean) J. & G.—Great Cat-fish.

Bluish slate above, whitish below. Form of  $\vec{i}$ . lacustris, but the body deeper and the head and mouth broader. Greatest depth  $3\frac{1}{2}$  in length. Head  $3\frac{3}{3}$ ; its width  $4\frac{3}{4}$ . Dorsal nearer snout than adipose fin. Candal fin not deeply forked. P. I, 11; A. 35. (Bean.) Mississippi River (Saint Louis). Probably the largest of the cat-fishes, the original type 5 feet in length and weighing 150 pounds.

(Amiurus ponderosus Bean, Proc. U. S. Nat. Mus. ii, 286, 1879.)

- aa. Bony bridge from occiput to dorsal fin complete and continuous.
  - d. Anal moderate, its rays 24-30, its base  $3\frac{1}{2}$ -4 in length of body.

# 108. I. punctatus (Raf.) Jor.—Channel Cat; White Cat.

Color light olivaceous above, the sides pale or silvery, and almost always with irregular small, round, dark spots. Fins often with dark edgings. Body rather long and slender, the back little elevated. Head rather small, narrow, convex above, so that the eye is little

nearer the upper than the lower outline. Eye large, the middle point of the length of the head being near its posterior margin. Mouth rather small. Barbels long. Spines long. Skin thin. Humeral process long and slender, more than half the length of the pectoral spine, which is strongly serrated behind. Head 4; depth 5. Anal 25–29. Rivers of the Southern and Western States, from Montana to Vermont, Mexico, and Georgia; generally abundant in the channels of the larger streams. It reaches a weight of 20–25 pounds. Variable.

(Silurus punctatus Raf. Amer. Month. Mag. 1818, 359; Jordan, l. c. 76; Pimelodus caralesceus Raf. Ichth. Oh. 63; Pimelodus candafurcatus Le Snenr, Mém. Mus. v, 152; Amiurus candafurcatus Günther, v, 102; Pimelodus furcifer, gracilis, vulpes, olivaceus, houghi, megalops, graciosus, hammondi, notatus, etc. Auct.: Ictalurus beadlei and simpsoni Gill: Ichthwlurus robustus Jordan, l. c. 76.)

dd. Anal fin very long, its rays 32-34.

# 109. I. furcatus (Cuv. & Val.) Gill.

Color silvery, plain or somewhat spotted. Anal fin extremely elongate, its base nearly one-third the length of the body (without caudal); its rays 32–34 in number. Eye small, wholly anterior, the middle of the head being entirely behind its posterior margin. Head small, about 4½ in length; depth 4 in adults to 5½ in younger specimens. Slope from dorsal to snout somewhat concave, especially in adults. Pectoral spine rather long; humeral spine stout, shortish, not reaching middle of pectoral spine. Skin thin. Size rather small. Ohio to Iowa and Texas; not very common.

(Pimelodus furcatus Cuv. & Val. xv, 133, 1840: Amiurus furcutus Günther, v, 103; Jordan, I. c. 75.)

#### 57.-ARIUS Cuvier & Valenciennes.

# Sea Cat-fish.

Couvier & Valenciennes, Hist, Nat. Poiss, xv, 53, 1840: type Pimelodus arius Buchanan.)

Body more or less elongate, subterete. Head subconical, armed with a bony shield above, behind which are usually two others, the posterior at the base of the dorsal spine. Skull with a fontanelle. Mouth not large, the upper jaw the longer. Teeth villiform or granular, in a band in each jaw. Teeth in one or two patches each on the vomer and palatines, all of them sometimes confluent into one band. Barbels 6 (the nostrils without barbel), close together, the posterior with a valve. Eyes with a free orbital margin. Dorsal fin short, in front of the ventrals, with a pungent spine and 7 rays. Adipose fin well developed, posteriorly free. Candal fin deeply forked. Anal fin short. Pectorals each with a spine. Ventral rays 6. Skin smooth, naked, except on the

occipital and nuchal regions, which are armed with bony bucklers. Marine cat-fishes. Species very numerous in the tropical seas. This group has been divided into many genera, the value of which we are unable to determine. Our common species is not a typical Arius, but the genus to which it belongs has not been properly defined. (From Ari gagora, the Bengalese name of the typical species.)

a. Teeth all villiform, in a large rounded patch on each palatine and a small one on each side of the vomer, these patches all distinct; posterior buckler small. (Ariopsis\* Gill.)

# 110. A. felis (Linné) J. & G.—Sea Cat-fish.

Steel-blue, sides and belly silvery. Body rather clongate, not compressed, tapering into the slender tail. Head subconic, depressed, flattish above. Maxillary barbel nearly as long as the head. Mouth small. Eye moderate, just in front of the middle of the head. Gill membranes broadly united, partly joined to the isthmus, forming a narrow, free fold across it. A small, bony, granulated buckler, broader than long, in front of base of dorsal spine; then a much larger nuchal shield with a median keel, and a still larger occipital shield with a median furrow. A low fleshy keel along the back. Humeral process nearly half the length of the pectoral spine. Caudal deeply forked, the upper lobe the longer. Head  $3\frac{3}{4}$ ; depth 5. D. I, 7, its spine not filamentous, serrate in front; P. I, 6; A. 16. L. 24 inches. Cape Cod to Florida; common southward.

(Silurus felis Linné, Syst. Nat.: Arius milberti Cuv. & Val. xv, 74: Arius milberti Günther, v, 155.)

#### 111. A. equestris Baird & Girard.

Similar, but with the spines higher and the maxillary barbels much longer, reaching to the middle of the pectorals. Pectorals reaching to last ray of dorsal. Dentition and character of the cephalic bucklers undescribed. Head 4. D. I, 7; A. 16; P. I, 9. Coast of Texas; a doubtful species.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1855, 26; Günther, v, 173.)

#### 58.—ÆLURICHTHYS Baird & Girard.

Sea Cat-fishes.

(Ailuriehthys Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 26: type Silurus marinus Mitchill.)

Body rather elongate, little compressed. Head depressed, broad above. Mouth large, the upper jaw the longer. Teeth all villiform; those on the vomer and palatines forming a more or less perfectly erescent-

<sup>\*</sup> Ariopsis et Notarius Gill, Proc. Acad. Nat. Sci. Phila. 1863, 171: type Arius milberti C. & V. (Arius; ὁψις, appearance.)

shaped band. Barbels 4. Maxillary barbels band-like, very long. Chin with two short barbels. Nostrils close together, the posterior with a valve; nuchal region with a granulated, bony buckler. Fontanelle large, well forward. Dorsal fin short, in front of the ventrals, with 1 sharp spine and 7 rays. Pectorals with a similar spine; both pectoral and dorsal spines ending in a long, striated, band-like filament. Adipose fin moderate, free behind. Caudal fin widely forked. Anal moderate or rather long. Ventral rays 6. Gill membranes somewhat connected. Tropical waters of America; the species all marine. (αξλουρος, cat; λχούς, fish.)

# 112. Æ. marinus (Mitchill) B. & G.—Sea Cat-fish; Gaff-top-sail.

Dusky bluish, silvery below. Head rather short and broad, rounded anteriorly. Eye rather large, low, anterior. Occipital buckler subtriangular, tapering behind. Maxillary barbels extending about to the end of the pectoral spine. Pectoral spine longer than the dorsal spine, two-thirds the length of the head, its filament reaching the vent. Dorsal filament reaching adipose fin. Upper lobe of caudal much the longer. Anal fin falcate. Band of palatine teeth nearly continuous. Head 4½. D. I, 7; A. 23; P. I, 12; B. 6; Vert. 20 + 30. Cape Cod to Mexico; common southward.

(Silurus marinus Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 433; Günther, v, 178.)

# ORDER L.—PLECTOSPONDYLI.

(The Plectospondylous Fishes.)

Physostomous fishes with the parietals broad, distinct; pterotic normal; symplectic present; opercular bones all present; no interclavicles, and the four anterior vertebræ much modified and with ossicula auditus. This group consists principally of fresh-water fishes, and includes about six families. Two strongly marked divisions are included in it, the one the suborder *Erentognathi* of Professor Gill, and the other the Characins, referred by Professor Gill to the *Isospondyli*. The Characins resemble the *Isospondyli* in general appearance and in the structure of the pharyngeals, but differ in the modification of the anterior vertebræ. (πλεκτὸς, joined together; σπάνδολος, vertebræ.)

#### ANALYSIS OF FAMILIES OF PLECTOSPONDYLI.

\*Brain case produced between orbits; basis cranii simple; only two superior pharyngeal bones; lower pharyngeals falciform, parallel with the gill-arches; jaws toothless. (Erentognathi.\*)

<sup>\*</sup> εὐ, well; ἐντός, within; γνάθος, jaw.

- \*\* Brain case not produced between orbits; basis cranii double, sometimes with muscular canal; 4 to 1 superior pharyngeal bones; lower pharyngeals not falciform; 3 basal branchihyals; teeth in jaws often present. (Characini.)

CHARACINIDÆ, 32.

# FAMILY XXX.—CATOSTOMIDÆ.

(The Suckers.)

Body oblong or elongate, usually more or less compressed. Head more or less conoid. Opereles normally developed. Nostrils double. No barbels. Mouth large or small, usually protractile and with fleshy lips. Margin of upper jaw formed in the middle by the small premaxillaries, and on the side by the maxillaries. Jaws toothless. pharyngeal bones falciform, armed with a row of numerous comb-like teeth. Branchiostegals 3. Gill membranes more or less united to the isthmus, restricting the gill-openings to the sides. Gills 4, a slit behind the fourth. Pseudobranchiæ present. Scales cycloid, large or small. Lateral line decurved, sometimes wanting. Head naked. Fins not scaly. Dorsal fin comparatively long (of 11-50 rays), without true spine. Anal fin short. Caudal fin more or less forked. Ventrals abdominal, with about 10 rays. Pectoral fins placed low, without spine. No adipose fin. Belly not serrated. Alimentary canal long. Stomach simple. No pyloric eœca. Air-bladder large, divided into two or three parts by transverse constrictions, not surrounded by a bony capsule. Genera 14 or fewer; species about 60; inhabiting the fresh waters of North America, two species in Eastern Asia. They are not much valued as food fishes, the flesh being flavorless and full of small bones.

(Cyprinidae, group Catostomina Günther, vii, 12-24.)

- \* Dorsal fin elongate, its developed rays 25-50 in number; air-bladder in two parts. † Fontanelle present; body ovate; scales large. (Bubalichthyina.)
  - a. Dorsal rays 24-33.

    - bb. Month smaller, inferior, protractile downwards.
      - c. Pharyngeal bones strong, the teeth comparatively coarse and large, increasing in size downwards......Bubalichthys, 60.
  - cc. Pharyngeal bones narrow, with the teeth thin and weak. CARPIODES, 61. ttFontanelle obliterated by the union of the parietal bones; body elongate. (Cycleptina.)
    - d. Mouth small, inferior, with thick papillose lips; scales rather small.

      CYCLEPTUS, 62.

- \*\* Dorsal fin short, with 10-18 rays. (Catostomina.)
  - c. Air-bladder in two parts.
    - f. Lateral line complete and continuous; scales small, 55-415 in the lateral line.
      - - h. Mouth inferior, small, with thick papillose lips.

Catostomus, 64.

- hh. Mouth very large, terminal, oblique; lips thin and nearly smooth.
  - i. Pharyugeal bones moderate, with teeth of medium size.

Chasmistes, 65.

- Pharyngeal bones slender, with very numerous, minute teeth.
   LIPOMYZON, 66.
- ff. Lateral line interrupted or wanting; scales large (40-50 in a longitudinal series).
- - j. Month normal, the lower lip entire or merely lobed.

    - kk. Pharyngeal bones very strong, with the lower teeth much enlarged, subcylindrical and truncate, the teeth of the upper part of the bone small and compressed; mouth large, somewhat oblique, with very thick lips.

Placopharynx, 70.

jj. Mouth singular, the upper lip not protractile, greatly enlarged, the lower lip developed as two separate lobes, pharyngeal bones and teeth ordinary....QUASSILABIA, 71.

# 59.—ICTIOBUS Rafinesque.

# Buffalo-fishes.

(Rafinesque, Ichth. Oh. 1820, 55: type Amblodon bubalus Raf.)

Head very large and strong, wide and deep; its length 3½-3¾ in that of the body; its upper surface broad and depressed. Eye moderate, wholly anterior in position, the middle of the head being entirely behind it; suborbital bones proportionately narrow. Fontanelle large, well open. Opercular apparatus largely developed; the suboperculum broad; the operculum broad, strongly furrowed. Mouth very large for a sucker, terminal, protractile forwards; the middle of the premaxillaries nearly on the line of the middle of the eye; the posterior edge of the maxillary extending about to the line of the nostrils. Mandible very strong, oblique, placed at an angle of 45° or more when the mouth is closed, its posterior end extending to beyond opposite the front of the eye, its length a little less than one-third that of the head. Lips very little developed; the upper narrow and smooth, scarcely appreciable; the lower narrow, rather full on the sides, but reduced to a narrow rim in front,

Bull. Nat. Mus. No. 16-8

entirely destitute both of papille and plice. Jaws without cartilaginons sheath. Muciferous system of head well developed. Istlimus nar-Pharyngeal bones rather weak, the outer surface of the arch standing outwards and presenting a porous outer margin. The peduncle of the symphysis is much longer proportionally and more pointed than in Carpiodes and Bubalichthys. The teeth are very numerous, small. thin, and compressed as in Carpiodes, but the lower ones are gradually larger than the upper ones. Their inner edge is slanting outwards. and not uniformly arched as in Bubalichthys, or truncate as in Cyclentus. the innermost margin rising somewhat in the shape of a projecting casp. Gill-rakers of anterior arch long and slender above, becoming shorter downwards. Body heavy, robust, not especially arched above nor greatly compressed, the form somewhat elliptical; the depth 23-33 in the length of the body. Scales large, thick, nearly equal over the body. their posterior edges somewhat serrate; the lateral line well developed. but not as distinct as in Carpiodes, slightly decurved anteriorly: the number of scales in its course 36-42; 13-15 in a transverse series from dorsal to ventrals. Dorsal fin with an elongate basis, its number of rays 25-30; anterior rays somewhat elevated, their length about half that of the base of the fin. Caudal not much forked. Anal fin not much elevated, its rays about 9 in number. Pectorals and ventrals moderate, the latter with about 10 rays. Sexual peculiarities, if any, unknown. Coloration dark, not silvery. Air-bladder with two chambers. Size very large. A single species known. (ἰχθός, fish; βοῦς, buffalo.)

# 113. I. bubalus (Raf.) Ag.—Red-mouth Buffalo-fish.

Body robust, moderately compressed, the outline somewhat elliptical, but the back rather more curved than the belly; depth  $2\frac{1}{2}-3\frac{1}{2}$  in length. Head very large and thick,  $3\frac{1}{2}$  in length of body. Opercular apparatus very strong, the operculum itself forming nearly half the length of the head. Scales very large. Developed rays of the dorsal 27–29; anal rays 9; ventrals 10. Scales 7–37 to 41–6. Coloration dull brownish olive, not silvery. Fins dusky. Size very large; reaches a length of nearly 3 feet and a weight of 20–30 pounds. Mississippi Valley; generally abundant in the larger streams.

(Amblodon bubalus Raf. Johnn. Phys. 1818, 421; Agassiz, Amer. Johnn. Sci. Arts, 1854, 196; Sclerognathus cyprinella C. & V. Hist. Nat. Poiss. 1844, 477; \*Ichthyobus cyanellus Nelson, Bull. Ill. Mus. Nat. Hist. i, 49; Ichthyobus bubalus Jordan, Bull. U. S. Nat. Mus. xii, 214; Sclerognathus cyprinella Günther, vii, 24.)

<sup>\*</sup> See Jordan, Bnli. U. S. Nat. Mus. xii, 207. There has been perhaps a confusion among Mr. Nelson's types of this species. One sent by him to us is an *Ictiobus*.

#### 60.-BUBALICHTHYS Agassiz.

# Buffalo-fishes.

(Agassiz, Amer. Journ. Sci. Arts, 1855, 192: type Carpiodes urus Ag.)

Head moderate or rather large deep and thick, its superior outline rapidly rising; its length about 4 in that of the body. Eye moderate, median or rather anterior in position. Suborbital bones comparatively Fontanelle always present and widely open. Month moderate or small, more or less inferior; the mandible short, little oblique, or typically quite horizontal; the mandible less than one-third the length of the head; the premaxillaries in the closed mouth below the level of the lower part of the orbit. Lips rather thin, thicker than in Ictiobus. the upper protractile, narrow, plicate, the plicae sometimes broken up into granules; lower lip comparatively full (for a buffalo-fish), faintly plicate, the plicae broken up into granules, the lower lip having the general A-shaped form seen in Carpiodes. Jaws without cartilaginous sheath. Muciferous system well developed. Opercular apparatus well developed, but less so than in *Ictiobus*; the operculum strongly rugose; isthmus moderate. Pharyngeal bones triangular, with large teeth. which increase in size from above downwards. Teeth compressed, their grinding edge blunt, slightly arched in the middle, and provided with a little cusp along the inner margin, which is hardly detached from the erown, and does not rise above the surface. Gill-rakers of anterior arch slender and stiff above, growing shorter downwards. Body ovate or oblong; the dorsal outline more or less arched; the sides of the body compressed; the ventral outline curved also, but to a less degree. Scales very large, about equal over the body, their posterior outlines somewhat serrate. Lateral line well developed, nearly straight, with 35-42 scales; 12-14 in a cross-series from ventrals to dorsal. Dorsal fin beginning near the middle of the body, somewhat in advance of the ventrals; its anterior rays elevated, their height about equal to half the base of the fin, the number of rays in the dorsal fin ranging from 25 to 30. fin well forked, the lobes about equal, not falcate. Anal fin comparatively long and rather low, of 8 or 9 developed rays. Ventrals moder-Pectorals rather short. Sexual peculiarities, if any, unknown. Coloration dull dark brown, nearly plain, not silvery. Fins olivaceous or more or less dusky. Air-bladder with two chambers. quite large. This genus is closely related to Ictiobus, differing only in

the somewhat stronger teeth. The two genera, with perhaps *Carpiodes* also, should probably be reunited. Three species are known, two in the United States and a third in Central America.\* (βούβαλος, buffalo; ἐχθύς, fish.)

# 1 14. 18. terrors Ag. -Big-mouthed Buffalo.

Body much less elevated and less compressed than in *B. altus*, the back not at all carinated; axis of body above ventrals about at the lateral line, and but very little farther from the dorsal outline than from the ventral; depth 3-34 in length. Head very stout, strongly transversely convex, thicker, larger, and less pointed than in the other, about 4 in length. Eye about equal to snout, 5½ in head, much smaller than in *B. altus*. Month large, considerably oblique, opening well forwards. Mandible longer than eye. Premaxillary somewhat below suborbital. Dorsal fin lower and less rapidly depressed than in the next, the longest ray scarcely half the length of the base of the fin. Anal fin rounded; its rays not rapidly shortened; the middle ones not much shorter than the longest. Colors very dark; fins all black. Scales 8-41-7; D. 30; A. 10. Mississippi Valley; in the larger streams.

(Carpiodes urus Agassiz, Amer. Journ. Sci. Arts, 1854, 355; Bubalichthys urus, niger, et bonasus Agassiz, Amer. Journ. Sci. Arts, 1855, 193-195; Jordan, l. c. 200.)

#### 115. B. altus Nelson.—Small-mouthed Buffalo.

Body considerably elevated and compressed above; the dorsal region subcarinate; belly thicker; depth  $2\frac{1}{2}$ - $2\frac{3}{4}$  in length; axis of body above the ventrals, below the lateral line, and nearly twice as far from the back as from the belly. Head moderate, triangular in outline when viewed from the side, 4 in length. Eye equal to snout, 4-5 in length of head, much larger than in B. urus. Mouth quite small, notably smaller and more inferior than in B. urus. Mandible about equal to eye. Dorsal fin elevated in front and rapidly declined, the highest ray reaching much beyond the middle of the fin, the seventh ray about half the length of the third or longest. Anal rays rapidly shortened behind, the middle rays much shorter than the first long ones. Scales 8-39-6;

<sup>\*</sup>B. meridionalis (Günther) Jordan. Mouth small, inferior, slightly corrugated. Depth 3½-3½ in length. Head 4-4½, not much longer than high. Lye rather small, one-fifth of the length of the head and two-fifths that of the snout. Suborbitals narrow. Anterior dorsal rays not much produced, shorter than the head. Caudal forked. Origin of ventral vertically below the fourth dorsal ray. Pectoral fin not extending to ventrals. There are 5 longitudinal series of scales between the lateral line and the root of the ventral. Coloration uniform. Scales 7-38-7; D. 29; A. 10. Rio Usumacinta, Guatemala. (Günther.) (Sclerognathus meridionalis Günther, vii, 23.)

D. 29; A. 10; V. 10. Coloration paler; the lower fins slightly dusky. Mississippi Valley and southward; generally abundant.

(Catostomus bubalus Kirtland, Rep. Zoöl, Ohio, 1838, 168, not of Rafinesque: Bubalichthys bubalus Agassiz, Amer. Journ. Sci. Arts. 1855, 195: Bubalichthys bubalus Jordan, I. c. 206: Selerognathus urus Günther, vii, 22; B. altus Nelson MSS. in Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 73; apparently the oldest tenable name, certainly belonging to the species.)

61.—CARPIODES Rafinesque.

Carp Suckers.

(Sclevoquathus Valenciennes.)

(Rafinesque, Ichth. Oh. 1820, 56: type Catostomus cyprinus Le Sneur.)

Head comparatively short and deep, sometimes conic, sometimes blunt; its length ranging from 31 to 5 in that of the body; its upper surface always rounded. Eve moderate, median or anterior in position. Suborbital bones well developed, their depth about half that of the fleshy portion of the cheek below. Fontanelle always present, well developed. Mouth always small, horizontal and inferior; the mandible less than one-third the length of the head; the lips thin, the upper protractile, narrow, the lower quite narrow, A-shaped, or rather A-shaped, behind; both lips feebly plicate or nearly smooth, the plica often more or less broken up. Jaws without cartilaginous sheath. Muciferous system moderately developed. Opercular apparatus well developed; the subopercle broad; the operculum in the adult more or less rugose. Isthmus moderate. Pharyngeal bones remarkably thin and laterally compressed, with a shallow furrow along the anterior margin on the inside, and another more central one on the outline of the enlarged surfaces. Teeth very small, compressed, nearly equally thin along the whole inner edge of the bone, forming a fine, comb-like crest of minute serratures; their cutting edge rises above the inner margin into a prominent point. Gill-rakers of anterior arch slender and stiff above, becoming reduced downwards. Body ovate or oblong; the dorsal outline more or less arched; the ventral outline more nearly straight; the depth from half to one-third the length; the sides compressed, the back notably so, forming a sort of carina. Caudal peduncle short and deep. Scales large, about equal over the body, their posterior margins slightly serrate; lateral line well developed, nearly straight, with 34-41 scales; 12-15 scales in a cross-row from dorsal to ventrals. Dorsal fin beginning near the middle of the body, somewhat in advance of ventrals, falcate; its anterior rays elevated and often filamentous, their height ranging from ½ to 13 the length of the base of the fin; the number of developed rays ranging from 23 to 30. Caudal fin well forked, the lobes equal. Anal fin comparatively long and low, emarginate (in males), its number of developed rays usually 8. Ventrals shortish, with usually 10 rays. Pectorals short. Sexual peculiarities little marked; in some species, at least, the males in spring have the snout minutely tuberculate. Coloration always plain; pale olivaceous above, white below, but hardly silvery, the fins all partaking of the color of the region to which they belong. Air-bladder with two chambers. Size medium or rather large. This genus is very close to *Ictiobus* and *Bubalichthys*. Its species are numerous and very difficult to determine. All belong to the United States. (Latin *carpiodes*, carp-like.)

- \* Dorsal fin with the anterior rays more or less shortened, their length one-half to two-thirds that of the base of the fin; muzzle more or less conic and projecting.
  - a. Head short, 4-5 in length.

# 116. C. carpio (Raf.) Jordan. - Carp Sucker.

Head comparatively short, its length contained 4-5 times in the length of the body. Body more fusiform than in the others, compressed, but not much arched, the depth  $2\frac{3}{3}$ -3 times in the length. Anterior rays of dorsal short, notably thickened and osseous at base, especially in the adult; the first ray nearer the end of the muzzle than the base of the caudal fin, the longest ray a little more than half the base of the fin; caudal moderately forked. Eye medium, anterior,  $4\frac{1}{2}$  in head. Muzzle short, but projecting much beyond mouth. D. 30; Lat. I. 36. Size largest of the genus. Mississippi Valley; generally abundant.

(Catostomus carpio Rafinesque, Ichth. Oh. 1820, 56; Jordan, l. c. 200: Carpiodes nummifer Cope, Proc. Amer. Phil. Soc. Phila. 1870, 484.)

aa. Head intermediate, its length contained about 4 times  $(3\frac{8}{4}-4\frac{1}{8})$  in that of body; anterior rays of dorsal not thickened at base.

#### 117. C. turnidus B. & G.-Carp Sucker.

Body elongate, not much elevated; the depth  $2_4^3$  in length. Head  $3_4^3$ -4; the muzzle prominent, but rather bluntish. Front searcely concave above eyes, the profile forming a somewhat uniform curve. Eye small, nearly 6 in head. Anterior rays of dorsal moderately elevated, less than three-fourths the length of the fin; the first ray nearly midway between snout and base of caudal. Caudal lobes blunt; suborbitals narrow, small. Scales 6-37-5; D. 24-27; A. 8; V. 10. Ohio to the Rio Grande and Upper Missouri; common. Distinguished from

the preceding by the much smaller eye. This description is based on specimens from Wabash River.

(Carpiodes cyprinus\* Jordan, I. c. 198; Carpiodes tumidus Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 28; Carpiodes damalis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 170; Carpiodes grayi Cope, Proc. Amer. Phil. Soc. Phila. 1870, 482.)

#### 118. C. thompsomi Agassiz.—Lake Carp.

Body stout, short, the back much arched, the depth  $2\frac{1}{2}$  in length. Head 4 to  $4\frac{1}{4}$  in length, the muzzle moderately pointed. Dorsal rays considerably elevated, two-thirds as long as base of fin. Eye small,  $5\frac{1}{4}$  in head. Tip of lower jaw much in advance of nostrils, maxillary reaching line of orbit. Anterior suborbital large, deep, roundish. Origin of dorsal about midway of body. Scales rather closely imbricated, 8–39 to 41–6; D. 27; A. 7; V. 10. Great Lake region; abundant. Perhaps identical with the preceding.

(Agassiz, Amer. Jonrn. Sci. Arts, 1855, 191; Jordan, I. c. 198.)

aaa. Head long, about 31 in length.

#### 119. C. bison Agassiz.

Head long, contained about  $3\frac{1}{2}$  times in length to base of caudal. Muzzle elongate-conic, so that the eye is nearly median, the middle of the length of the head falling in front of its posterior margin. Body not much arched, depth 3 in length. Anterior rays of dorsal pretty high, not much shorter than the base of the fin, not thickened at base. Lips well developed. Eye large,  $4\frac{1}{2}$  in head. Scales 7–40–5; D. 27; A. 7; V. 10. Mississippi Valley.

(Agassiz, Amer. Journ. Sci. Arts, 1854, 356; Cope, Proc. Amer. Phil. Soc. Phila. 1870, 483; Jordan, I. c. 197.)

**120. C. cyprimis**† (Le Sueur) Agassiz.—Quillback; Spear-fish; Sail-fish; Skimback. Muzzle conic, projecting, obtusely pointed, tip of the mandible reaching to opposite nostrils; maxillary reaching to opposite front of orbit. Anterior suborbital as deep as long. Head  $3\frac{3}{4}$ -4 in length. Eye large,  $3\frac{1}{2}$ - $4\frac{1}{2}$  in length of head. Body much arched above, the depth  $2\frac{1}{4}$ - $2\frac{1}{2}$  in length. First ray of dorsal usually nearer muzzle than base of

<sup>\*\*</sup>Dorsal fin with the anterior rays very much elevated and attenuated, about equalling, or more usually exceeding, the length of the base of the fin.

<sup>\*</sup>The original Catostomus cyprinus was described from tributaries of Chesapeake Bay. It cannot be the present species, as the dorsal is described and figured as strongly falcate and the candal deeply forked. We have seen no specimens from the original locality.

<sup>†</sup>Possibly two or three species are here included; relifer, with the anterior dorsal rays longer than the fin; cyprinus, with them somewhat shorter; and cutisanscrinus, with a blunter snout and the dorsal rays very long.

caudal. Caudal deeply forked, its lobes slender, the upper the longer. Scales 7-37-5; D. 26 or 27. Chesapeake Bay to Mississippi Valley; generally abundant.

(? Catostomus cyprinus Le Sneur, John. Acad. Nat. Sci. Phila. 1817, 91; Günther, vii, 12: Catostomus velifer Rafinesque, Ichth. Oh. 1820, 56: Carpiodes velifer Cope, Proc. Amer. Phil. Soc. Phila. 1870, 482: Carpiodes velifer Jordan, 1. c. 196: Carpiodes eutisanserinus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 481: Carpiodes cutisanserinus Jordan, 1. c. 196: Carpiodes selene Cope, Proc. Amer. Phil. Soc. Phila. 1870, 41.)

#### 121. C. difformis Cope.

Muzzle exceedingly blunt, so that the anterior edge of the mandible is in line with the anterior rim of the orbit, and the maxillary reaches to the anterior edge of the pupil. Anterior suborbital deeper than long. Head  $4\frac{1}{4}$  in length. Eye quite large,  $3\frac{1}{2}-4$  in head. Body arched, the depth somewhat less than half the length. First ray of dorsal nearer muzzle than base of caudal. Scales 6–35–4; D. 24; A. 8; V. 9. Ohio Valley; not common. Perhaps a deformity of the preceding.

(Cope, Proc. Amer. Phil. Soc. Phila, 1870, 480; Jordan, l. c. 195.)

# 62.-CYCLEPTUS Rafinesque.

#### Black Horse.

(Rafinesque, Journ. Phys. Chim. Hist. Nat. Paris, 1819, 421: type Cycleptus nigrescens Raf. = Catostomus elongatus Le Sueur.)

Head very small, short and slender, its length contained 6-7 times in that of the body; its upper surface rounded. Eye small, behind the middle of the head; not very high up, its length 6-8 in that of the head. Suborbital bones small and narrow. Fontanelle entirely obliterated by the union of the parietal bones. Mouth small, entirely inferior, overlapped by the projecting snout; the upper lip thick, pendent, covered with 3-5 rows of tubercles, the outer quite large, the inner small; lower lip moderate, formed somewhat as in Catostomus, but less full, incised Jaws with rudimentary cartilaginous sheath. Muciferous system not greatly developed. Opercular apparatus not greatly developed; the operculum smooth and narrow. Isthmus moderate. Gillrakers moderately long, soft. Pharyngeal bones strong; the teeth stout, increasing in size downwards, rather wide apart. Body elongate, moderately compressed, not much elevated; the candal peduncle long; the greatest depth contained 4-6 times in length. Scales moderate, about equal over the body, not closely imbricated, with wide, exposed surfaces, the number in the lateral line from 55-60, and about 17 in a transverse series from dorsal to ventrals. Edges of scales crenate. Latera! line well developed, nearly straight. Fins rather large, dorsal fin beginning in front of ventrals and ending just before anal, of about 30 rays, strongly falcate in front, the first and second developed rays in length more than half the length of the base of the fin, the rays rapidly shortened to about the eighth, the length of the remaining rays being nearly uniform and all short. Caudal fin large, widely forked, the lobes about equal. Anal fin quite small, low, of 7 or 8 developed rays, scaly at base. Ventrals moderate, with 10 rays. Pectorals clongate, somewhat fal cate. Sexual peculiarities somewhat marked; the males in spring with black pigment; the head then covered with small tubercles. Air-bladder with two chambers, the anterior short, the posterior clongate. One species known. (εὐελως, round; λεπτός, slender. "The name means small round mouth."—Rafinesque.)

122. C. clongatus (Le Sueur) Ag.—Black Horse; Gourd-seed Sucker; Missouri Sucker; Suckerel.

Depth 4-5 in length; head  $6-8\frac{1}{2}$ . Eye small, 6-7 in length of head. Longest dorsal rays a little longer than head. Pectorals rather longer than head. Dorsal rays 30; anal 7 or 8; scales 9-56-7. Coloration very dark, the males almost black. Size large. Length of adult  $1\frac{1}{2}-2\frac{1}{2}$  feet. Mississippi Valley; rather common. A singular and interesting fish.

(Catostomus elongatus Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 103: Selerognathus elongatus Günther, vii, 23; Jordan, I. c. 189.)

#### 63.-PANTOSTEUS Cope.

# Hard-headed Suckers.

(Cope, Lient. Wheeler's Expl. W. 100th Mer. v, 673, 1876: type Minomus platyrhynchus Cope.)

Head moderate or rather small, 4-5 times in length of body, flattish and rather broad above, anteriorly somewhat pointed. Eye rather small, usually behind the middle of the head. Suborbital bones narrow, Bones of head rather thick, the two parietal bones as in Catostomus. firmly united, entirely obliterating the fontanelle. Month rather large, entirely inferior; each jaw with a more or less developed cartilaginous sheath, separable in alcohol, essentially as in Chondrostoma, Acrochilus, and related genera. Upper lip broad, papillose, with a rather broad, free margin and 2 or more series of tubercles. Lower lip largely developed, with an extensive free margin deeply incised behind, but less so than in Catostomus. Pharyngeal bones and teeth essentially as in Catos-Isthmus quite broad. Body generally clongate, subterete, and little compressed. Scales quite small, 80-105 in the course of the lateral line and 30-35 in a cross-series between dorsal and ventrals, usually more or less reduced in size and crowded forward, as in Catostomus.

Lateral line well developed, straightish. Fins generally rather small. First ray of dorsal usually about midway of body, its rays few, 9–12 in number. Ventrals inserted rather under posterior part of dorsal, their rays 10 or 9. Anal short and high, with 7 developed rays. Caudal rather shallow-emarginate. Pectorals well developed. Air-bladder with two chambers. Size rather small. Species numerous in the Rocky Mountain region.  $(\pi \hat{a}\nu, \text{ all}; \nu\sigma\tau\ell\nu\nu, \text{ bone.})$ 

## 123. P. piebeius (Baird & Girard) Jordan.

Body rather stout, subfusiform. Head slender, rather short,  $4\frac{9}{3}$  in length. Eye 5 in head. Ventrals reaching nearly to vent. Scales small, scarcely crowded anteriorly, 80 in the lateral line, 20–30 in a cross-series. Depth  $4\frac{1}{2}$  in length. Dorsal midway between snout and upper caudal rays. Caudal short, emarginate. Color dark brown, faintly mottled; sides with orange in the males. (*Girard*.) Lake Guzman, Mexico.

(Catostomus plebeius Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 28: Catostomus plebejus Günther, vii, 15; Jordan, l. c. 184.)

#### 124. P. delphimus Cope.

"The dorsal outline is arched, the head flat above, not elevated behind and much depressed on the muzzle. The muzzle is wide and does not project beyond the upper lip, which is appressed to its lower face and bears four rows of warts; its smooth commissural part is narrow. On the lower lip the tubercles advance nearly to the commissure; this lip is deeply emarginate posteriorly. The eye enters the length of the head 5 times,  $2\frac{1}{2}$  times measuring the muzzle, and twice the interorbital region. Head  $4\frac{2}{3}$  times in length to end of candal basal scales. Scales in 30 longitudinal series, between dorsal and ventral fins. Ventrals remarkably short, extending little more than half way to vent, originating under posterior third of dorsal. Pectorals well separated. Isthmus wide. Color above blackish, with a strong inferior marginal shade on the lower part of the sides, and the lighter tint above; a brown spot just above axilla is cut off from it by a band of the yellow color which covers the belly and head below." (Cope.) Probably from Green River.

(Minomus delphinus Cope, Hayden's Geol. Surv. Wyom. Terr. 1872, 436.)

# 125. P. bardus Cope.

This species is distinguished by its very short head and marked coloration, resembling in that respect the *C. guzmaniensis* of Girard; with

<sup>\*</sup> Scales moderate, 80-85 in the lateral line.

a. Scales subequal over the body, not reduced forwards.

this species it has, however, nothing else in common, "Head wide, muzzle not projecting beyond upper lip; latter not pendant, with narrow, smooth commissure and 3 or 4 rows of tubercles. Lower lip deeply incised, tubercular to near inner edge. Eye 5.25 times in length of head, twice in interorbital width. Head 5 times to end of basal candal scales. Form stout. Body cylindric anteriorly. Dorsal fin nearer end of muzzle than end of candal scales. Scales of body subcound, in 30 longitudinal rows between dorsal and ventral fins, latter originating beneath hinder border of dorsal, not unite reaching vent. Pectorals well separated. Isthmus wide, narrower than in M. delphinus. Color blackish above: a broad olive band from upper part of opercular border along upper half of caudal peduncle, and a broad black band below, narrowing to a line along the middle of the peduncle; below yellowish, a band of the same cutting off a blackish area above the axilla, as in the last species." (Cope.) Probably from Green River. This species and the two preceding are not well separated.

(Minomus bardus Cope, Hayden's Geol. Surv. Wyom. Terr. 1872, 436.)

aa. Scales very much reduced and crowded anteriorly; upper lip full, pendent; cartilaginous sheaths on jaws well developed, the commissure transverse and abruptly angulate at the corners of the mouth.

# 126. P. platyrrhymchus Cope.

Body extremely elongate, the depth 5½-7 in length. Head 4¼ in length, short and wide, with depressed and expanded muzzle, which considerably overhaugs the mouth. Isthmus very wide. Dorsal rays 11; ventral rays 9; scales 15–86–12. Belly and lower fins yellowish, probably red in life. Utah Lake. Perhaps identical with the next.

(Minomus platyrhynchus Cope, Proc. Amer. Phil. Soc. Phila, 1874, 134; Jordan, l. c. 183.)

#### 127. P. generosus (Girard) Jordan.

Body moderately elongate, the depth 4½-5 in the length. Head rather short,  $4\frac{2}{3}$  in length, not specially broadened; muzzle not greatly overhanging the mouth. Lower lip full, with 4 or 5 rows of tabercles; upper with 2. Isthmus very broad. Head with conspicuous mucous tubes. Lower fins large. Dorsal rays 9 (rarely 10); ventral rays 10 (rarely 9); scales 11 to 14-83 to 87-13 to 15. Light brown above, with dusky spots and clouds; males with the chin and fins red, and a crimson lateral band. Rio Grande to Mojave Desert and Great Basin of Utah; very abundant.

(Catostomus generosus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 174: Minomus jarrovii Cope, Proc. Amer. Phil. Soc. Phila. 1874, 35; Jordan, l. c. 183.)

<sup>\*\*</sup> Scales very small, 100-105 in the lateral line.

#### 128. P. virescens Cope.

Body elongate, compressed, the candal peduncle contracted. Head short, wide, 5 in length. Muzzle obtuse, little projecting. Upper lip wide; lower lip full, emarginate. Jaws with well-developed cartilaginous sheaths. Scales much reduced in size forwards. Dorsal rays 10; ventral 9; scales 18–103–16. Color olive; lower surface yellow. Headwaters of Arkansas River.

(Cope, Wheeler's Expl. W. 100th Mer. v, 675, 1876; Jordan, l. c. 182.)

#### 61.—CATOSTOMUS Le Sneur.

#### Suckers.

(Hylomyzon Agassiz; Acomus and Minomus Girard.)

(Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 89, 1817: type Cyprinus catostomus Forster = Catostomus longirostrum Le Sueur.)

Head more or less elongate, its length ranging from 3½ to 5 times in that of the body. Eye usually rather small, high up, and median or more or less posterior in position. Suborbital bones narrow, longer than broad, much as in Moxostoma. Fontanelle always present, usually widely open, in two species reduced to a narrow slit, but never wholly obliterated. Mouth rather large, always inferior, and sometimes notably so; the upper lip thick, protractile, papillose; the lower lip greatly developed, with a broad free margin, deeply incised behind, so that it forms two lobes, which are often more or less separated. Mandible horizontal, short, not one-third the length of the head and not reaching to opposite the eye. Lower jaw usually without distinct cartilaginous sheath. Opercular apparatus moderately developed, not rugose. Pharyngeal bones moderately strong, the teeth shortish, vertically compressed, rapidly diminishing in size upwards, the upper surface of the teeth nearly even or somewhat cuspidate. Body oblong or elongate, more or less fusiform, subterete, more or less compressed. Scales comparatively small, typically much smaller and crowded anteriorly, the number in the lateral line ranging from about 50 to 115, the number in a transverse series between dorsal and ventrals from 15 to 40. Lateral line well developed, straightish, somewhat decurved anteriorly. Fins variously developed. Dorsal with its first ray nearly midway of the body, with from 9 to 14 developed rays. Analtin short and high, with probably always 7 developed rays. Ventrals inserted under the middle or posterior part of the dorsal, typically with 10 rays; in one subgenus usually 9; the number often subject to variation of one. Caudal fin usually deeply forked, the lobes nearly equal. Sexual peculiarities not much

marked; the fins higher in the male and the anal somewhat swollen and tuberculate in the spring. Breeding males in some species with a rosy or orange lateral band. Air-bladder with two chambers. Vertebrae in C. commersoni and C. nigricans 45–47. Species very numerous, all belonging to the United States, except the Siberian C. rostratas Tilesius. ( $z\dot{a}z\omega$ , inferior;  $\sigma z\dot{a}y\omega$ , mouth.)

- \*Scales very small, much reduced and crowded anteriorly, \$3-115 in the lateral line. (Catostomus.)
  - a. Fontanelle almost obliterated, reduced to a narrow slit; each jaw with a well-developed cartilaginous sheath (as in Pantosteus).

# 129. C. discobolus Cope.

Body subterete, compressed behind, the depth 5 in length. Interorbital space 2 in head. Head quite short, broad and rounded above,  $4^3_4$  in length. Eye small, far back and high up, 6 in head. Month very large, inferior, beneath the projecting snont. Upper lip very full, pendent, with about 5 rows of tubercles. Lower lip very full, moderately incised, with about 10 rows, a notch separating the upper lip from the lower. Each jaw with a slightly curved cartilaginous sheath on its edge, the two parallel with each other and fitting closely together. Fins small. Dorsal 11; candal little forked; scales 15–90–11, irregular. Colors dusky. Size small. Idaho to Wyoming and Arizona.

(Cope, Hayden's Geol, Surv. Wyom, Terr. 1870, 435; Jordan, l. c. 179.)

- aa. Fentanelle well developed; jaws without evident cartilaginous sheath,
  - 5. Upper lip very broad, with several (5 or 6) rows of large papillæ.

#### 130. C. Ratipinnis Baird & Girard.

Body slender and clongate; the caudal peduncle especially long and very slender; the depth 5\frac{1}{4} in the length. Head moderate, 4\frac{1}{4} in length, rather slender, with prominent shout and rather contracted, inferior mouth. Outline of the mouth triangular, the apex forwards. The lips very thick, greatly developed; lower lip incised to the base; its posterior margin extending backwards to opposite the eye. Jaws with a slight cartilaginous pellicle. Eye small, high up. Preorbital bone broad, scarcely twice as long as deep. Scales long and low, posteriorly rounded, their horizontal diameter greater than the vertical, 17-98 to 105-17. Fins excessively developed, especially in the males, the free border of the dorsal deeply incised. Height of each of the three vertical fins in the males greater than the length of the head. Dorsal 13, inserted nearer shout than base of caudal. Caudal very strong, the rudimentary rays at its base unusually developed. Least depth of tail less

than one-third the head. Coloration silvery; the males probably rosy and tuberculate in spring. Gila region to Wyoming; not abundant.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 388; Günther, vii, 14; Jordan, l. c. 478; ?? Catostomus guzmaniensis\* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 173.)

#### 134. C. retropinanis Jordan.

Body long and slender, subterete, compressed behind, the form essentially that of C. longirostris, the depth contained  $5\frac{1}{5}$  times in the length. Head large, 4 in length of body, the interorbital space broad and flat,  $2\frac{1}{2}$  in length of head. Eve small, high up and rather posterior. Preorbital bone very long and slender, its length about 3 times its Mouth large, precisely as in C. latipinais, the upper lip pendent, very large, with 5-8 series of tubercles. Dorsal fin not elongated or especially elevated, its rays 11, the beginning of the dorsal much nearer base of candal than snort. Caudal fin long and strongly forked. Anal fin long and high, reaching base of caudal. Ventrals not reaching yent. Caudal pedanele stout and deep, its least depth more than one-third length of head; its length about two-thirds that of head. Scales quite small, about as in *longirostris*, the exposed portion not notably lengthened. Chest with well-developed scales. Scales 16-100-14. Coloration dusky brown, a dusky lateral band, pale below, the dark colors extending low. Snout quite dark. Size large. Montana to Nebraska. (Jordan, l. e. 178.)

bb. Upper lip comparatively thin and narrow, with but few (3 or 4) rows of papilla.

# 132. C. longirostris Le Sueur.—Long-nosed Sucker; Northern Sucker.

Body elongate, subterete, the depth  $4\frac{1}{4}$ – $4\frac{3}{4}$  in length. Head quite long and slender,  $4\frac{1}{4}$ – $4\frac{3}{8}$  in length, depressed and flattened above, broad at base, but tapering into a long snout, which considerably overhangs the large mouth. Lips thick, coarsely tuberculate, the upper lip narrow, with 2 or 3 rows of tubercles. Eye rather small, behind the middle of the head. Scales very small, much crowded forwards, 95–114 in the course of the lateral line, and about 29 (26–31) in a cross-row from dorsal to ventrals. Dorsal rays 10 or 11. Males in spring with the head and anal fin profusely tuberculate, the tubercles on the head small; the sides at that season with a broad rosy band. Size large; the largest species in the genus. Great Lakes and Upper Mississippi Valley to

<sup>\*</sup>This is probably a distinct species. It is stonter than C. latipinnis, with shorter and deeper candal pedancle and lower fins. A blackish lateral band. D. 12; Lat. l. about 90. Upper lip with 4 rows of papillae. The original type from Lake Guzman, Chihuahua, is now lost.

Alaska; very abundant northward. The most widely distributed species.

(Cyprinus catostomus Forster, Phil. Trans. 1773, 155: Catostomus longirostrum and hudsonius Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 102, 107: Catostomus forsterianus Richardson. Franklin's Journal, 1823, 720: Catostomus aurora Agassiz, Lake Superior, 360: Catostomus hudsonius Günther, vii, 13: Catostomus griseus Günther, vii, 14; Jordan, I. c. 175.)

#### 133. C. tahoensis Gill & Jordan.—Tahoe Sucker.

Rather stouter, the depth 4½-5 in length. Head very large and long-acuminate, the muzzle nearly one-half itslength, overhanging the rather large mouth. Lips moderate, the upper pendent, with about 3 rows of small papillae; the lower rather full, similarly papillose. Eye nearly median, rather small, 8½ in head. Scales small and crowded forwards, closely imbricated, 85-90 in the course of the lateral line, and about 28 in a cross-series from dorsal to ventrals. Dorsal short, but longer than high, its rays 10. Coloration very dark; fins dusky; scales everywhere finely punctate. Breeding males profusely tuberculate. Size large. Lake Tahoe; very abundant.

(Jordan, I. c. 173; Jordan & Henshaw, Rept. Chief Engin. app. nn, 1878, 188.)

- \*\* Scales small, crowded, and smaller anteriorly than posteriorly, 58-75 in the course of the lateral line. (Decactylus Rafinesque.\*)
  - c. Upper lip thick and full, with several (5-8) rows of papillæ.
    - Fontanelle very small and narrow; both jaws with a weak cartilaginous sheath.

#### 134. C. armonus Jordan.

Body clongate, fusiform, subterete, the greatest depth 4¼-4½ in length. Head small, conical, 4% in length. Month quite large, with full, thick lips, the upper very wide and pendent, with about 6 rows of very strong papillæ; lower lip two-lobed, similarly papillose. Interorbital space wide, convex. Eye elevated, posterior, quite small. Fins moderate; dorsal higher than long, with 10, rarely 11, rays; ventral rays 10. Scales small, crowded forwards, 10 or 9-70-8. Color dark; scales with dark punctulations. Nevada and Southern California.

(Jordan, L. e. 173; Jordan & Henshaw, Rept. Chief Engin, app. nn, 1878, 188.)

- dd. Fontanelle well developed; lips without evident cartilaginous sheath.
  - e. Lateral line with 70-80 scales.

#### 135. C. labiatus Ayres.

Head 4½ in length, rather bluntish. Month moderate, the labial papillæ largely developed; the upper lip full, with about 5 rows of large

<sup>\*</sup> Rafinesque, Ichth. Oh. 1820, 60: type Catostomus bostoniensis Le Sueur. (δεκα, ten; δακτυλος, toes; i. e., 10 ventral rays.)

but rather sparse papillæ. Scales 12–74–10. Dorsal fin short, higher than long, of about 11 rays. Color dark above; sides clouded with black and yellow. Klamath Lake, Oregon. A little-known species.

(Ayres, Proc. Acad. Nat. Sci. Cal. 1855, 32; Jordan, l. c. 173.)

#### 136. C. Brackockillus Grd.—Columbia River Sucker.

Body heavy forwards. Head large and heavy, convex. Snout blunt, much overlapping the horizontal mouth. Mouth quite large, with very large lips, the upper full and pendent, with 6-8 rows of strong papille. Head large, 4½ in length, rather narrow, quadrangular, the snout projecting. Eye large. Dorsal fin much longer than high, its rays about 15. Pectorals long and narrow; caudal well forked. Head 4 in length. Scales 12-72-10. Coloration rather dark; a dusky lateral stripe; below abruptly pale. Columbia River.

(Girard, Proc. Acad. Nat. Sci. Phila, 1856, 175; Jordan, l. c. 171.)

# 137. C. occidentalis Avres. -Sacramento Sucker.

Body rather slender, little elevated. Mouth comparatively small, smaller than in *C. commersoni*; the upper lip with 5 or 6 rows of smallish papillæ; lips rather thin. Head quite small, rounded above, 4½ in length, the profile steeper than in *C. commersoni*, the snout more pointed, the two sides of the head more convergent forwards. Eye small. Dorsal fin longer than high, its rays 12–14; caudal well forked, the upper lobe the longer. Scales 13–75–10. Dark above, gradually paler below. Streams of California; abundant in the Sacramento and San Joaquin.

(Avres, Proc. Cal. Acad. Nat. Hist. 1854, 18; Jordan, l. c. 172.)

#### 128. C. bermardini Girard.

Color blackish. Fins rather high. Lateral line with 80 scales (according to the figure). Eye large. Head 5 in length. Mouth small, with broad lips. Rio Huagui, Mexico, west of the Sierra Madre. (Girard.) This species is, perhaps, allied to C. occidentalis, but may be a Pantosteus.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 175.)

ec. Lateral line with 60-65 scales.

# 139. C. ardens Jor. & Gilb.

Body rather elongate, little compressed, the back broad. Head broad, conical. Mouth entirely inferior, the mandible horizontal; upper lip very wide, full, pendent with about 8 rows of coarse, irregular papillæ; lower lip very broad, coarsely papillose, cut to the base by a sharp incision. Eye very small, 7 in head, 3½ in interorbital width. Dorsal fin long and low, its anterior rays three-fourths the base of the fin, half

longer than the last rays; pectorals and ventrals short; caudal short; anallong. Pharyngeal bones rather weak, with smallish teeth. Blackish above; males with the sides rosy; fins dark. Head 3; depth 4½. D. 13; A. 7; scales 9-65-9. L. 18 inches. Utah Lake.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 464, 1880.)

#### 140. C. feenadus Cope & Yarrow.—Utah Lake Sucker.

Body moderately stont, little compressed, the tail slender. Head subconic, the profile regularly decurved from the nape to the base of the premaxillary spines, which abruptly protrude, forming a distinct "nose" as in *Chasmistes liorus*; premaxillaries in front searcely below the preorbital. Mandible large, oblique, placed at an angle of 30° when the mouth is closed, its length 3 in head. Upper lip full, pendent, with about 4 rows of coarse papillæ; lower lip moderate, divided by a broad notch, each lobe with about 6 rows of papillæ. Eye a little behind middle of head. First ray of dorsal twice height of the last, its length greater than that of the base of the fin; caudal forked, the lower lobe longest; pectorals long; anal high. Dusky above, pale below. Head 4; depth 4½. D. 11; A. 7; V. 9; scales 8–60–8. L. 13 inches. Utah Lake; excessively abundant. This species has evident affinities with *Chasmistes*.

(Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. v, 678, 1876; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 463.)

cc. Upper lip comparatively thin, with but few (2 or 3) rows of papillie.

f. Scales much reduced, and crowded anteriorly; dorsal rays 11-15.

# 141. C. cypho Lockington.

A conspicuous hump behind the occiput, supported by a greatly expanded, broadly triangular interneural bone. Upper lip with about 3 rows of papillae, lower lip with about 8; the lower lip divided to the base by a broad emargination. D. 15; A. 8; V. 10; Lat. 1. 72. Colorado River at mouth of Gila. (Lockington.)

(Lockington, Proc. Acad. Nat. Sci. Phila. 1880.)

# 142. C. commersoni (Lacépède) Jordan.—Common Sucker; White Sucker; Brook Sucker; Fine-scaled Sucker.

Body moderately stent, varying with age, subterete, heavy at the shoulders, the depth 4-43 in length. Head rather large and stout, conical, flattish above, its length 4-41 in body (3½-4¼ in young). Shout moderately prominent, scarcely overpassing the mouth. Mouth rather large; the lips strongly papillose, the upper moderate, with 2 or 3 rows of papille. Scales crowded anteriorly, much larger on the sides than below; scales 10-64 to 70-9. Coloration olivaceous; males in

Bull, Nat. Mus. No. 16-9

spring with a faint rosy lateral band; young brownish, more or less mottled, often with confluent blackish lateral blotches or a lateral band. Lateral line usually imperfect in the young. L. 18 inches. All streams from Labrador to Montana, and southward to Florida. The commonest of the suckers.

(Cyprinus commersoni Lacépède, Hist. Nat. Poiss. v, 502, 1803: Cyprinus teres Mitchill, Trans. Lit. & Phil. Soc. N. Y. 1814, 458: Catostomus teres Günther, vii, 15: Catostomus teres Jordan, l. c. 166: Catostomus communis and bostonicusis Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 95, 106, etc.)

ff. Scales scarcely reduced or crowded anteriorly; dorsal rays 10 or 11.

#### 143. C. imsigmis Baird & Girard.

Body rather elongate, subterete, heavy at the shoulders, tapering backward, the depth about 5 in length. Head moderate, about 4½ in length. Mouth comparatively small. Lips moderate, the upper narrow, with about 2 rows of large tubercles. Scales subequal, 58-63 in the lateral line, 19 in a cross-series. A series of dusky spots along each row of scales, the spots often obscure. Gila Basin.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 28; Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. v, 676, 1876; Jordan, L. c. 165.)

#### 144. C. clarki Baird & Girard.

Body moderately stout, depth  $4\frac{9}{3}$  in length. Head very small and short, about 5 in length. Eye moderate. Fins all notably small. Scales small, subequal, 9-70-9; larger mesially than posteriorly. Body with scattered nebulons spots. (Girard.) Arizona.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 27.)

\*\*\* Scales moderate, not crowded anteriorly, 48-55 in the lateral line; head peculiarly formed. (Hypentelium Rafinesque.\*)

# 145. C. migricums Le Sueur.—Hog Sucker; Stone Roller; Toter; Crawl-a-bottom; Hammer-head; Stone Lugger; Hog Molly.

Head flattened above, transversely concave between the orbits, the frontal bone thick, broad, and short, the physiognomy being therefore peculiar. Ventral rays normally 9. Upper lip very thick, strongly papillose, with a broad, free margin, which has upwards of 8–10 series of papillæ upon it; lower lip greatly developed, strongly papillose, considerably incised behind, but less so than in *Catostomus* proper. Fontanelle shorter and smaller than in *C. commersoni*. Pectoral fins unusually large. D. 10 or 11; Lat. I. 48–55; 12–15 scales in a cross-

<sup>\*</sup> Rafinesque, Journ. Acad. Nat. Sci. Phila. 1818, 421: type Exoglossum macropterum Raf. = Catostomus nigricans Le Sueur. ( $i\pi \delta$ , below;  $\pi i v \tau \eta$ , five; labinum, lip, the five-lobed lower lip being supposed to distinguish it from Exoglossum.) (= Hylomyzon Ag.)

series. Depth 4½-5 in length; head 4-4½. Eye rather small, 4½ to 5 in head. Color olivaceous; sides with brassy lustre; belly white; back brown, with several dark cross-blotches, irregularly arranged, these becoming obsolete in old individuals; lower fins dull red, with some dusky shading; young considerably variegated, the sides spotted. Size large; maximum length about 2 feet. New York to Alabama and Kansas; abundant. Ascends streams to spawn early in spring.

(Le Sueur, Journ. Acad. Nat. Sci. Phila. 1818, 102: Hylomyzon nigricans Agassiz, Amer. Journ. Sci. Arts, 1855, 205; Günther, vii, 17; Jordan, I. c. 162.)

#### 65.—CHASMISTES Jordan.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, No. 2, 417.1878; type Chasmistes liorus Jor.)

Head disproportionally large, forming more than one-fourth of length. broad and flattish above; sides of head vertical, slightly directed inwards, the breadth through the cheeks less than the breadth above the eyes. Eyes small, high up, rather posterior. Mouth extremely large, terminal, the lower jaw in the closed mouth being very oblique, placed at an angle of about 45 degrees. The lower jaw very long and strong. its length more than one-third the length of the head, nearly half the length of the head in the adult, its tip, when the mouth is closed, about on a level with the eye. Upper jaw very protractile. Upper lip very thin (for a sucker), and nearly smooth. Snout elevated above the rest of the head, the premaxillary spines usually forming a conspicuous nose. Lower lip moderate, consisting of a broad flap on each side of the mandible, in front reduced to a narrow rim, the surface of the lip nearly smooth, without papille. Nostrils large. Suborbital bones narrow, but rather broader than in Catostomus. Preorbital unusually large. Mucous channels moderately developed. Fontanelle very large. Isthmus rather Pharyngeal bones weaker than usual in Catostomus, the teeth generally smaller. Body rather slender, tapering pretty regularly from the shoulders to the tail, but little compressed. Caudal peduncle rather stout. Fins moderate; the dorsal rays about 12; the anal 7. Pectorals rather long, not quite reaching ventrals; ventrals reaching vent; anal fin high, reaching caudal; caudal fin rather long, its lobes equal. Scales moderate, large on the caudal peduncle, much smaller and crowded anteriorly, 60-65 in the lateral line, about 18 in a transverse series from dorsal to ventrals. Sexual peculiarities unknown. Coloration usual. Air-bladder in two parts. Size moderate or rather large. (χασμάω, to yawn.)

 a. Pharyngeal bones of moderate strength; the upper teeth minute, the lower enlarged. (Chasmistes.)

# 146. C. Horus Jordan.-June Sucker of Utah Lake.

Depth about 5 in length; head 32. Interorbital space broad, 24 in head. Eye 6-7 in head. Width of the open mouth 35 in head. D. I, 11, the fin elevated in front, its anterior ray twice the height of the posterior and about equal to the base of the fin; A. I, 7; caudal deeply forked, the lower lobe long; lower fins small. Scales 9-63-8. Color dusky above, pale below; the scales of the back and sides profusely covered with dark punctulations. L. 18 inches. Utah Lake; abundant.

(Jordan, Bull. U. S. Nat. Mus. xii, 219, 1878.)

aa. "Pharyugeal bones very thin and flat, with very numerous minute teeth, as in Carpiodes." (Lipomyzon Cope.\*)

#### 147. C. brevirostris Cope.

"Shorter than *C. luxatus*, especially the muzzle, and the latter is without the hump produced by the protuberant premaxillary spines. Parietal fontanelle small. The lower lip fold is only present on the sides of the mandible. Body nearly cylindric. Scales 12–74–11. Radii: D.11; A. 9. Color dusky above, silvery below; fins colorless." (*Cope.*) L. 16 inches. Klamath Lake, Oregon.

(Cope, American Naturalist, 1879, 785.)

#### 148. C. luxatus Cope.

"Form elongate. Head long, flat above, and with a large fontanelle. Mouth terminal, the spines of the premaxillary projecting so as to form a hump on the top of the snout. Lower lip a very thin dermal fold, extending entirely around the chin. Scales 12–80–9. Radii: D. 11; A. 9. Color clouded above, with black punctulations, below paler, with red shades in some specimens; fins uncolored." (Cope.) L. 3 feet. Klamath Lake and River.

(Cope, American Naturalist, 1879, 784.)

#### 66.—ERIMVZON Jordan.

Chub Suckers.

(Moxostoma Ag.; not of Raf.)

(Jordan, Bull. Buffalo Soc. Nat. Hist. 1876, 95: type Cyprinus oblongus Mitch. = Cyprinus succetta Lac.)

Body oblong, rather shortened, heavy forwards, and considerably compressed. Head moderate, rather broad above. Mouth moderate,

<sup>\*</sup>Cope, Amer. Nat. Jan. 1381, 59: type Chasmistes brevirostris Cope. ( $\lambda \varepsilon i\pi \omega$ , to be deficient;  $\mu \dot{\psi}_{\pi}^2 \omega$ , to suck.)

somewhat inferior; the upper lip well developed, freely protractile; the lower moderate, infolded, A-shaped in outline, plicate, with 12-20 plicate on each side. Lower jaw without cartilaginous sheath, rather stronger than usual, and oblique in position when the mouth is closed, thus similar to the mouth of Ictiobus. Eye moderate, rather high up, placed about midway of the head. Suborbital bones considerably developed, not very much narrower than the fleshy portion of the check below them: the posterior suborbital concavo-convex, about twice as long as deep, sometimes divided; the anterior somewhat deeper than long, sometimes divided into two, sometimes united with the preorbital bone, which is well developed, and much longer than broad. Opercular bones moderately developed, searcely or not rugose. Fontanelle rather large. Gill-rakers rather long. Isthmus moderate. Pharyngeal bones weak; the teeth quite small, slender, and weak, rapidly diminishing in length upwards, each tooth narrowly compressed, with a cusp on the inner margin of the cutting surface, and some inequalities besides. Scales rather large, more or less crowded forwards, sometimes showing irregularities of arrangement; the longitudinal radiating furrows much stronger than usual; the scales rather longer than deep, but so imbricated in the adult that the exposed surfaces appear deeper than long. Lateral line entirely wanting. Scales in the longitudinal series from head to base of caudal 35-45 in number; scales in transverse row from base of ventral to dorsal 12-18. Dorsal fin rather short and high, with 10-14 developed rays, the number usually 11 or 12. Beginning of dorsal fin rather nearer shout than base of candal. Pectoral fins moderate, not reaching ventrals; the latter not to vent. Ventrals under a point rather in advance of the middle of dorsal; their rays normally 9, but occasionally 8 or 10. Anal fin high and short, more or less emarginate or bilobed in adult males. Caudal fin moderately forked or merely lunate, its two lobes about equal. Air-bladder with two chambers. Two species known. ( $\xi \rho i$ , an intensive particle;  $\mu \delta \zeta \omega$ , to suck.)

# 149. E. succita (Lac.) Jordan.—Creek Fish; Chub Sucker.

Body oblong, compressed, becoming gibbons with age, the ante-dorsal region more or less clevated in the adults, the depth  $3\frac{1}{4}$  in length, ranging from  $2\frac{3}{4}$  in adults to 4 in young. Head stout, short, about  $4\frac{1}{4}$  in length  $(4-4\frac{1}{2})$ , the interorbital space wide and depressed, the lower parts narrower. Eye not large,  $4\frac{3}{4}$  in head  $(4\frac{1}{2}-5\frac{1}{2})$ . Mouth protractile downwards and forwards, the mandible oblique. Scales usually closely imbricated

and more or less crowded forwards, but often showing various irregularities in arrangement, about 43 (39-45) in a longitudinal series and 15 (14-16) in a transverse series between the ventrals and the dorsal. Finrays somewhat variable, the dorsal with 11 (10-13) developed rays, the anal with 7, and the ventrals with 9 (rarely 8). Coloration varying with age; never distinct series of black spots along the rows of scales. Young with a broad black lateral band, bordered above by paler. some specimens from clear water this band is of a jet-black color and very distinct; in others it is duller. Later this band becomes broken into a series of blotches, which often assume the form of broad transverse bars. In adult specimens these bars disappear, and the color is nearly uniform brown, dusky above, paler below, everywhere with a coppery or brassy, never silvery, lustre. The fins are dusky or smoky brown, rarely reddish-tinged. Sexual differences strong. The males in spring with usually three large tubercles on each side of the snout, and with the anal fin more or less swollen and emarginate. Adult specimens with the back gibbous and the body strongly compressed, in appearance quite unlike the young. Maximum length about 10 inches. New England to the Rocky Mountains, south to Texas; very abundant.

(Cyprinus succtta Lac. Hist. Nat. Poiss. v, 606, 1803: Cyprinus oblongus Mitch. Trans. Lit. & Phil. Soc. i, 459, 1814: Mocostoma oblongum Giinther, vii, 21: Catostomus gibbosus Storer, Fish Mass. 291; Jordan, Man. Vert. 319; Jordan, Bull. U. S.Nat. Mus. xii, 144.)

# 150. E. goodei Jordan.

Body oblong, the back more elevated, the body deeper and more compressed than in the preceding, the greatest depth in advance of the dorsal fin being contained about  $2\frac{3}{4}$  times in the length. Nape less gibbous than in E. succetta. Head quite small and short, the large eye being almost exactly midway in its length. Its length  $4\frac{1}{2}$  in that of the body. Eye  $4\frac{1}{4}$  in head. Interorbital space rather narrow, transversely convex, less than half the length of the head. Mouth small, protractile forwards, the lower jaw oblique; lips as in the preceding. Scales large, much larger and much more uniform in their imbrication than in E. succetta, 36 in a longitudinal series, and about 13 in a transverse series from the ventrals to the dorsal. Dorsal fin high, of 12 developed rays; anal moderate, with 7; ventrals large, with 10. Cofor dark of vaccous above; each scale along the sides reflecting pale from the strongly striated middle part, these giving in cer-

tain lights the appearance of pale stripes along the rows of scales; fins dusky, especially at their tips. Rivers of Florida.

(Jordan, Bull. U. S. Nat. Mus. xii, 148, 1878.)

#### 67 .- MEN WTREMA Jordan.

Spotted Suckers.

(Jordan, Man. Vert. E. U. S. ed. 2, 318: type Catostomus melanops Raf.)

Head moderate, rather broad above. Mouth moderate, inferior, horizontal; the upper lip well developed, freely protractile; the lower rather small, infolded, A-shaped in outline, plicate, with 12-20 plica on each side. Lower jaw without cartilaginous sheath. Eve moderate, rather high, placed about midway of the head. Suborbital bones considerably developed, not very much narrower than the fleshy portion of the cheek below them; the posterior suborbital concavo-convex, about twice as long as deep, sometimes divided; the anterior somewhat deeper than long, often divided into two, sometimes united with the preorbital, which is well developed and much longer than broad. The number and form of these bones, except as to their depth, are not constant in the same species, and do not afford specific characters. Opercular bones well developed, not much rugose. Fontanelle evident, rather large. Gill-rakers rather long, in length about half the diameter of the eye. Isthmus moderate. Pharyngeal bones essentially as in Moxostoma. Body rather elongate, subterete, becoming deep and rather compressed with age. Scales rather large, nearly equal over the body, the radiating furrows not specially marked. Lateral line interrupted in the adult, but with perfect tubes, imperfect in partly grown specimens, entirely obsolete in the young. Scales in a longitudinal series 41-47 in number, 12-14 in a transverse series from dorsal to ventrals. Dorsal fin rather short and high, with about 12 developed rays, beginning rather nearer the snort than the base of the caudal. Pectoral fins moderate, not reaching ventrals, the latter not to vent. Ventrals rather in advance of the middle of the Gorsal, their rays normally 9, rarely 8 or 10. Anal fin high and short, often more or less emarginate in males. Caudal fin moderately forked, the lobes about equal. Air-bladder with two chambers. Males in spring with the head covered with many small tubercles. One species certainly known.\* (μωνς, reduced; τρῆμα, aperture; in allusion to the imperfections of the lateral line.)

<sup>\*</sup> M. austrinum Bean. Body rather stout, the depth 4 in length. Head  $4\frac{1}{8}$  in length. Lips plicate, truncate behind. Light brown above, yellowish below; some scales brownish at base. Paired fins with dark blotches. D. 11; A. 6; scales 6-44-6. Michoacan, Mexico (west of Sierra Madre). This species is probably a Minytrema, but the air-bladder has been removed from the typical specimens.

<sup>(</sup>Myxostoma austrina Bean, Proc. U. S. Nat. Mus. 1879, 302.)

# 151. M. melanops (Raf.) Jordan.—Spotted Mullet; Striped Sucker.

Body oblong, little compressed, the young nearly terete, the adults deeper bodied; the dorsal region not elevated. Depth about 4 in length, varying from about 3 in adults to 45 in the young. Head not very large, 4\frac{1}{3} in length of body (4\frac{1}{2}-4\frac{1}{3}), not specially depressed. Mucous pores rather strong. Eye small, 5-6 in head. Mouth quite inferior, horizontal, rather small. Scales large, firm, regularly and smoothly imbricated, in 46 (44-47) longitudinal series and 13 (12-14) transverse series, the scales not crowded forwards. Fin-rays usually: D. 12: A. Coloration dusky above, with usually a black blotch behind the dorsal fin. Each scale along the sides with a small, more or less distinct blackish spot at its base, these spots forming interrupted longitudinal lines along the rows of scales. These lines are usually very distinct, especially in the adult, but young specimens often show them faintly. Sides and belly silvery, with a coppery lustre. Sexual peculiarities moderately marked; very old males with the head covered with small tubercles in spring. No great changes with age, either in form or coloration. Size large; maximum length about 18 inches. Great Lake region to South Carolina and Texas.

(Catostomus melanops Raf. Ichth. Oh. 1820, 57: Catostomus fasciatus Günther, vii, 19; Jordan, Man. Vert. 318; Jordan, Bull. U. S. Nat. Mus. xii, 138.)

### 68.-MOXOSTOMA Rafinesque.

Red Horse.

(Ptychostomus Ag.; Teretulus Raf.)

(Rafinesque, Ichth. Oh. 1820, 54: type Catostomus anisurus Raf.)

Body more or less elongate, sometimes nearly terete, usually more or less compressed. Head variously long or short, its length ranging from 3½ to 5½ in that of the body. Eye usually rather large, varying from 3 to 6 times in the length of the side of the head, its position high up and median or rather posterior. Suborbital bones very narrow, always much longer than broad, their width less than one-fourth that of the fleshy part of the cheek. Fontanelle on top of head always well open, the parietal bones not coalescing. Mouth varying much in size, always inferior in position, the mandible being horizontal or nearly so. Lips usually well developed, the form of the lower varying in different sections of the genus, usually with a slight median fissure, but never deeply incised; the lips with transverse plice, the folds rarely so broken up as to form papille. Jaws without conspicuous cartilaginous

sheath. Muciferous system considerably developed, a chain of tubes along the supraorbital region, a branch of which extends around behind the eye and forwards along the suborbital bones and the lower edge of the preorbital. Opercular bones moderately developed, nearly smooth. Isthmus broad. Gill-rakers weak, moderately long. Pharyngeal bones rather weak, much as in Erimozon and Catostomus, the teeth rather coarser, strongly compressed, the lower 5 or 6 much stronger than the others, which are rapidly diminished in size upwards, each with a prominent internal cusp. Scales large, more or less quadrate in form, nearly equal in size over the body, and not specially crowded anywhere, usually about 44 in the lateral line (41-56) and about 12 series between dorsal and ventrals. Lateral line well developed, straight or anteriorly curved. Fins well developed, the dorsal inserted about midway of the body, its first rays usually rather nearer shout than the caudal, the number of developed rays usually about 13, but varying in different species from 11 to 17. Anal fin short and high, usually emarginate in the male fish, probably always with 7 developed rays. Ventrals inserted nearly under the middle of the dorsal; their number of rays normally 9, occasionally varying to 10; the occurrence of 10 ventral rays is probably an accidental individual character, and not a permanent specific one. Candal fin deeply forked, the lobes about equal, except in two species. Air-bladder with three chambers. Skeleton essentially as in Catostomus, the vertebra in M. carpio 27-14. Sexual peculiarities little marked, the males in the spawning season with the lower fins reddened, and the anal rays swollen and somewhat tuberculate. Species very nnmerous in the United States east of the Rocky Mountains. spawn in spring, running up from the rivers into the smaller streams for that purpose. They are difficult to distinguish, and have perhaps been unduly multiplied by authors. (μύξω, to suck; στόμα, mouth; hence, more properly Myxostoma.)

# 152. BI. papillosum (Cope) Jordan.

Body comparatively stout, the dorsal region somewhat elevated and rounded, the depth being about 4 in length, the head about the same. Eye rather large, high up and well back, the preorbital space being longer than the other species. Top of head flat. Dorsal rays 12–14. Scales rather large, 6–42–5. Lips well developed, deeply incised.

<sup>\*</sup> Lips full, strongly papillose.

Color silvery; back with smoky shading; lower fins white. Size large; reaches a length of about 2 feet. North Carolina to Georgia.

(Ptychostomus papillosus Cope, Proc. Amer. Phil. Soc. Phila, 1870, 470; Jordan, Man. Vert, 318; Jordan, Ball. U. S. Nat. Mus. xii, 134.)

\*\* Lips distinctly plicate.

† Lower lip infolded, Λ-shaped when viewed from below, with a distinct median crease, in which the two halves of the lip meet, forming an acute angle; mouth small.

a. Dorsal large, with 15-17 developed rays.

#### 153. M. velmina (Cope) Jordan.

Body stout, deep, compressed, the back elevated, the depth 3-4 in length. Head short, heavy, flattish and broad above, 3\frac{3}{4}-4\frac{1}{4} in length. Depth of cheeks half the length of the head. Eye rather large, midway in head, 4-5 in its length. Muzzle rather prominent, bluntish, overhanging the very small mouth. Fins very large. Dorsal long and high, its height five-sixths the length of the head, its free border straight. Pectorals nearly reaching ventrals. Color silvery; smoky above; lower fins red. Size large. Upper Mississippi Valley to Georgia and southward.

(Ptychostomus relatus and collapsus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 471-472; Jordan, Man. Vert. 317; Jordan, Bull. U. S. Nat. Mus. xii, 132.)

aa. Dorsal moderate, with 12-14 developed rays.

b. Head comparatively large, about 4 in length; dorsal rays usually 12.

#### 151. M. Ducco (Cope) Jordan.

Head short and very wide through the opercles, flat above. Body stont, the back somewhat elevated, depth 4 in length. Muzzle subtruncate, slightly projecting. Scales 6-40-5. Olivaceons silvery below; dorsal fin dnsky. Kansas. (Cope.)

(Ptychostomus bucco Cope, Hayden's Geol. Surv. Wyom. 1-72, 437: Mysostomu congestum Jordan, Bull. U. S. Nat. Mus. xii, 133; probably not Catostomus congestus B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 27, which Professor Cope thinks is a form of M. macrolepidotum, he having obtained it in Texas and Arizona.)

# 155. M. pidiense (Cope) Jordan.

Head rather long, 4½ in length, flattish above. Body elongate, more nearly cylindrical, little compressed. Muzzle truncate. Olivaceous, sometimes with rows of faint spots along the series of scales. Dorsal and caudal fins black-edged. Size quite small. Resembles M. cervinum, but the month entirely different. Great Pedee River. (Cope.)

(Ptychostomus pidiensis, Proc. Am. Phil. Soc. Phila. 1870, 471; Jordan, Man. Vert. 317; Jordan, Bull. U. S. Nat. Mus. xii, 133.)

bb. Head very small, about 5 in length.

#### 156. M. coregonus (Cope) Jordan.—Blue Mullet.

Mazzle conie, much projecting beyond the very small mouth; body much compressed, broadly fusiform, the back elevated and arched. Dorsal rays 14. Color silvery, with plumbeous shades above; lower fins white. Size small. Catawba and Yadkin Rivers, North Carolina (Cope.)

(Ptychostomus coregonus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 472; Jordan, Man. Vert. 317; Jordan, Bull. U. S. Nat. Mus. xii, 134.)

th Lower lip thin, forming a narrow, crescent-shaped border around the mandible.

#### 157. M. album (Cope) Jordan.-White Mullet.

Head small, 5 times in length. Muzzle prominent, but less so than in *M. coregonus*. Month moderate. Back a little elevated. Depth about 33 in length. Dorsal rays 12–14, its free border often incised. Scales 6–45–5. Coloration very pale; lower fins white. Size large; reaches a weight of 4 pounds or more. Catawba and other rivers of North Carolina.

(Ptychostomus albus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 472; Jordan, Man. Vert. 316; Jordan, Bull. U. S. Nat. Mus. xii, 130.)

# 158. M. thalassinum (Cope) Jordan.

Head stout, as in *M. velatum*, rather long, 4 in length, flattish above, muzzle truncate, not very prominent. Mouth moderate. Back elevated. Dorsal fin long, of 14 or 15 rays. Sea-green above, white below; lower fins white. Yadkin River. (*Cope.*)

(Ptychostomus thalassinus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 472; Jordan, Man. Vert. 316; Jordan, Bull. U. S. Nat. Mus. xii, 131.)

ttt Lower lip full, its posterior edge truncate.

d. Dorsal rays 15-18 in number.

#### 159. M. carpio (Val.) Jordan.—Carp Mullet.

Dorsal fin largely developed, its rays 15–18 in number. Head rather large, 33–44 in length, broad above. Mouth large, with full lips. Eye rather large. Body deep, strongly compressed, the back somewhat elevated, the depth about 34 in length. Dorsal fin high and large, larger than in any other species of the genus, the first ray about as long as the base of the fin. Scales 5–43–4, quite large. Coloration very pale and silvery; the lower fins white. Ohio Valley, Great Lakes, and northward.

(Catostomus carpio Valenciennes, Hist. Nat. Poiss. xvii, 457, 1844: Catostomus carpio Günther, vii, 20; Jordan, Man. Vert. 312; Jordan, Bull. U. S. Nat. Mus. xii, 118.)

- dd. Dorsal rays 12-14 in number.
  - e. Scales large, 41-50 in the course of the lateral line.
    - f. Caudal fin normal, the two lobes about equal and similarly colored.

# 160. M. macrolepidotum (Le Sueur) Jordan.—Common Red Horse; Mullet; White Sucker; Large-scaled Sucker.

Head comparatively elongate, bluntish, rather broad and flattened above, 4–5 in length. Body stoutish, varying to moderately elongate. Lips rather full, the bluntish muzzle projecting beyond the large mouth; greatest depth of checks more than half distance from snout to preopercle. Eye rather large. Dorsal fin medium, its developed rays 12–14, usually 13 in number, its free edge nearly straight, its longest ray shorter than head. Scales large, about 45 in the lateral line. Olivaceous; sides silvery; lower fins in the adult red or orange. Great Lakes to Virginia, southwestward to Arizona; one of the most abundant fishes, reaching a length of 2 feet or more. The Red Horse of the Ohio and Mississippi, with the head relatively longer and the mouth larger, is perhaps worthy of distinction as var. duquesni (Le Sueur) Jor. The eastern form (var. macrolepidotum) is scarcely distinguishable from the next species.

(Catostomus macrolepidotus and duquesni Le Sueur, John. Acad. Nat. Sci. Phila. i, 94, 105, 1817: Catostomus crythrurus Ref. Amer. Month. Mag. 1818, 354: Catostomus duquesni Günther, vii, 18: Myxostoma macrolepidota and vars. duquesni and lachrymalis Jordan, Man. Vert. 313; Jordan, Bull. U. S. Nat. Mus. xii, 120: Ptychostomus duquesni, crythrurus, robustus, oncida, lachrymale, etc. Cope, Proc. Amer. Phil Soc. 1870. Myxostoma curyops Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 348, is probably a monstrosity of this species.)

#### 161. M. aureolum (Le S.) Jordan.

Head comparatively short, low and small, conic, 5-5½ in length. Back elevated and compressed. Depth 3½ in length. Month small, overpassed by the snout, the lips thin and small, the greatest depth of cheek half the distance from snout to preopercle. Eye small. Coloration bright yellowish brown, somewhat silvery; lower fins bright red. Dorsal rays 13, the fin somewhat falcate, its free edge concave, its longest ray longer than head. Scales 5-45-4. Great Lakes, Ohio Valley, and northward.

(Catostomus aureolus Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 95, 1817: Catostomus macrotepidotus Günther, vii, 18; Jordan, Man. Vert. 314; Jordan, Bull. U. S. Nat. Mus. xii, 124: ? Cyprinus lesueuri Rich, Franklin's Journ. 1823, 772.)

#### 162. M. crassilabre (Cope) Jordan.

Body flattish, the back elevated and compressed. Depth 34. Muzzle contracted, lower lip thick. Scales large, 5-44-5. Dorsal rays usually 12. Dorsal fin elevated in front, its first soft ray longer than the base of the fin. Color silvery, with smoky shading above, some of the scales

blackish at their bases; lower fins white; top of head, humeral bar, and dorsal fin dusky. Neuse River, North Carolina. (*Cope.*) Probably identical with the preceding.

(Ptychostomus crassilabris Cope, Proc. Amer. Phil. Soc. Phila. 1870, 477; Jordan, Man. Vert. 314; Jordan, Bull. U. S. Nat. Mus. xii, 123.)

## 163. M. conus (Cope) Jordan.

Body flattish, the dorsal outline elevated, the form being like that of M. coregonus. Head small and conic. Month exceedingly small, the snout far overpassing it, the muzzle being much longer than in M. crassilabre. Dorsal rays 14. Eye large. Coloration smoky above, some scales dusky at their bases; sides pale; lower fins white. Yadkin River, North Carolina. (Copc.)

(Ptychostomus conus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 478; Jordan, Man. Vert. 314; Jordan, Bull. U. S. Nat. Mus. xii, 126.)

ff. Candal fin with the upper lobe longer than the lower, the two similarly colored.

#### 164. M. anisurum (Raf.) Jordan.

Candal fin with the upper lobe falcate, much longer than the lower, at least in the adult, the lobes similarly colored. Dorsal fin short and high, falcate. Body compressed. Back somewhat elevated. Depth 3½ in length. Head conic, flattish, 5½ in length. Mouth very small, much as in aureolum, from which it can probably be distinguished only by the form of the candal. D. 12–13, half higher than long. Scales 6–46–5. Ohio Valley and Great Lake region.

(Catostomus anisurus Raf. Ichth. Oh. 54: Ptychostomus breviceps Cope, Proc. Amer. Phil. Soc. Phila. 1870, 478; Jordan, Man. Vert. 315; Jordan, Bull. U. S. Nat. Mus. xii, 126.)

fff. Candal fin with the lower lobe distinctly longer than the upper and differently colored, the upper lobe in the adult being red, the inferior jet-black, its two lowermost developed rays and their membranes abruptly pale (?in both sexes).

#### 165. M. pæcilurum Jordan.

Body elongate, moderately compressed, somewhat elevated forwards. Depth 43 in length. Head about the same. Month medium, the lips full. Dorsal rays 13. Scales large, 5–44–4. Coloration usual, except of the caudal fin; other fins all red, with blackish shadings. Size small. Louisiana and Southern Mississippi.

· (Jordan, Bull. U. S. Nat. Mus. x, 66; Jordan, Man. Vert. 315; Jordan, Bull. U. S. Nat. Mns. xii, 129.)

ee. Scales very small for the genus, about 56 in lateral line; body moderately elongate, the depth about 4 in length.

# 166. M. albidum (Grd.) Jordan.

Head shortish, conic, the snout not much projecting, about 4 in length; eye large. Dorsal fin small, with about 11 rays, the last rapidly

shortened. (Characters of mouth unknown, but probably similar to macrolepidotum and pæcilurum; it is said to be "much larger than in P. conaestus".) Rio Grande region. (Girard.)

(Ptychostomus albidus Grd. Proc. Acad. Nat. Sci. Phila. 1856, 172; Jordan, Man. Vert. 315; Jordan, Bull. U. S. Nat. Mus. xii, 128.)

ddd. Dorsal rays mostly less than 12; body very slender.

# 167. M. cervirum (Cope) Jordan.—Jumping Mullet; Jump-rocks.

Head very short, roundish above, rather pointed forwards, about 5 in length. Cheeks subvertical, their depth less than half the distance from snout to preopercle. Mouth rather large, with thick lips, which are strongly plicate, the folds somewhat broken up. Eye small. Fins very small; the dorsal rays 10–12; free edge of dorsal straight, its longest ray less than head. Scales rather large, 6–44 to 49–5. Color greenish brown; a pale blotch on each scale, these forming continuous streaks along the rows of scales; back with more or less distinct brownish cross-blotches; fins brownish, not much red, the dorsal blackish at tip. Size smallest in the genus. Length less than a foot. Rivers of the South Atlantic States from the James to the Chattahoochee.

(Teretulus cervinus Cope, Journ. Acad. Nat. Sci. Phila. 1868, 236: Ptychostomus cervinus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 478; Jordan, Man. Vert. 315; Jordan, Bull. U. S. Nat. Mus. xii, 129.)

#### 69.—PLACOPHARYNX Cope.

Big-jawed Suckers.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 467: type Placopharynx carinatus Cope.)

Suckers like Moxostoma in all respects, except that the pharyngeal bones are much more developed and the teeth reduced in number, those on the lower half of the bone very large, 6-10 in number, nearly cylindric in form, being but little compressed, and with a broad, rounded or flattened grinding surface. The forms and positions of these enlarged teeth vary greatly. In a specimen before us the first tooth is the highest and most compressed, its summit being rounded and then abruptly truncate. The second tooth is notably shorter and thicker, much larger, and rounded on top, the body of the tooth serving as a peduncle for the swollen grinding surface. The third tooth is still shorter and similar in form. The fourth tooth is similar to the first, being much higher than the second and third, and flat on top. The others seem to be irregularly alternated or arranged in pairs, a long one and a short one, the long teeth in all cases being the most truncated, as if their surfaces had been most worn off. The month is larger and more oblique than usual

in Moxostoma, and the lips are thicker. Size large. (πλάξ, a broad surface; φάρογξ, pharynx.)

# 168. P. carinatus Cope.

Body oblong, moderately compressed, heavy at the shoulders. Head very large, 3% in length of the body. Eye small, behind the middle of the head. Mouth extremely large, the lower jaw oblique when the mouth is closed, the mouth, therefore, protractile forwards as well as downwards. Lips very thick, coarsely plicate, the lower lip full and heavy, truncate behind. Head above evenly rounded or somewhat carinated. Scales 6-45-6. Dorsal rays 13; ventral 9. Color brassy green above; lower fins red. Great Lakes and Mississippi Valley; abundant in many streams.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 467; Jordan, Man. Vert. 311; Jordan, Bull. U. S. Nat. Mus. xii, 108.)

# 70 .- QUASSILABIA Jordan & Brayton.

# Hare-lip Suckers.

(Lagochila Jordan & Brayton, preoccupied.)

(Jordan & Brayton, Man. Vert. E. U. S. ed. 2, 1878, 401: type Lagochila lacera Jordan & Brayton.)

Suckers like Moxostoma in every respect excepting the structure of the mouth. Head shortish, conical, with lengthened snout; its length 43-5 times in that of the body, the opercular region being reduced, so that the eye is well backwards. Suborbital bones narrow. tanelle large, widely open. Mouth large, singular in structure, inferior, the upper lip not protractile, greatly prolonged, closely plicate. Lower lip much reduced, divided into two distinct elongate lobes, which are weakly papillose. The split between these lobes extends backwards to the edge of the dentary bones, which are provided with a rather hard, horny plate, as in *Pantosteus*. The lower lip is entirely separated from the upper at the angles by a deep fissure. The skin of the cheeks forms a sort of cloak over this fissure, the crease separating this skin from the mouth extending up on the sides of the muzzle. The crease between the lips extends down on the under side of the head. System of muciferous tubes well developed. Pharyngeal bones not dissimilar from the usual type in Moxostoma, rather weak, with numerous small teeth. Body elongate, not much compressed, not elevated. Fins moderate, formed as in Moxostoma. Scales large, as in Moxostoma, the lateral line well developed and nearly straight, with about 45 scales in its course. Air-bladder in three parts. Sexual peculiarities unknown; probably little marked. (Quassus, broken or torn; labia, lip.)

169. Q. lacera Jor. & Brayt.—Hare-lip Sucker; Cut-lips; Split-mouth Sucker; May Sucker; Rabbit-mouth Sucker.

Head short, conical, with lengthened snout, the region between the eyes flattened and with prominent mucous ridges. Cheeks and lower part of head rather swollen. Opercle much reduced, its greatest length scarcely greater than the diameter of the eye. Head about  $4\frac{2}{3}$  in length. Eye  $4\frac{1}{3}$  in length of head, about 2 in length of the snout, its situation thus quite posterior. Length of the top of the head  $2\frac{2}{3}$  in the distance from the snout to the base of the dorsal. Body rather slender, the form being between that of  $Moxostoma\ cervinum$  and  $M.\ maerolepidotum$ , the depth  $4\frac{2}{3}$  in the length. Dorsal fin rather low, its rays I, 12; A. I, 7; V. 9. Scales 5–45–5. Color olive or bluish brown above; sides and belly silvery; lower fins faintly orange. Ohio Valley and southward. A singular species, abundant in some sections (Scioto River, Clinch River, Chickamanga River), but overlooked by naturalists until lately.

(Lagochila lacera Jordan & Brayton, Proc. Acad. Nat. Sci. Phila. 1877, 280: Lagochila lacera Jordan, Man. Vert. ed. 2, 311: Jordan, Man. Vert. ed. 2, 406; Jordan, Bull. U. S. Nat. Mus. xii, 106.)

# FAMILY XXXI.—CYPRINIDÆ.

(The Carps.)

Cyprinoid fishes with the margin of the upper jaw formed by the premaxillaries alone and the lower pharyngeal bones well developed, falciform, nearly parallel with the gill-arches, each provided with 1-3 series of teeth in small number, 4-7 in the main row, and a less number in the others if more are present. Head naked. Body scaly (except in Meda, Plagopterus, Phoxinellus, and Aulopyge). Barbels 2 or 4; absent in most of our genera, and not large in any. Belly usually rounded, rarely compressed, never serrated. Gill-openings moderate, the membranes broadly joined to the isthmus. Brachiostegals always 3. Gills 4, a slit behind the fourth. Pseudobranchiæ present (except in Orthodon, etc.). No adipose fin. Dorsal fin short in American species, elongate in many Old World forms. Ventral fins abdominal. usually large, commonly divided into an anterior and posterior lobe, rarely wanting, not enclosed in a bony capsule. Stomach without appendages, appearing as a simple enlargement of the intestines. Fishes of moderate or small size, inhabiting the fresh waters of the Old World and of North America. Genera about 200; species nearly 1,000; excessively abundant where found, both in individuals and species, and, from their great uniformity in size, form, and coloration, constituting one of the most difficult groups in natural history in which to distinguish genera and species. Our genera are mostly very closely related, and are separated by characters which, although reasonably constant, are often of slight structural importance. From time to time, different authors have proposed to throw most of these groups into the genus *Leuciscus*, a procedure which, without further discussion, may be said to have always led to confusion. The spring or breeding dress of the male fishes is often peculiar. The top of the head, and often the fins or various portions of the body, are covered with small tubercles, outgrowths from the epidermis. The fins and parts of the body in the spring males are often charged with bright pigment, the prevailing color of which is red, although in some genera it is satin-white, yellowish, or black.\*

(Cuprinida, part, Günther, vii, 25-339.)

\* Dorsal fin short, without developed spine.

†Air-bladder surrounded by many convolutions of the very long alimentary canai.

A. Teeth 4-4, or 1, 4-1, 0, with oblique grinding surface and slight hook; peritoneum black.

Campostoma, 71.

tt Air-bladder above the alimentary canal; teeth one-rowed. (Chondrostomina.)

‡ Intestinal canal elongate, more than twice the length of the body; teeth with
grinding surface well
developed; peritoneum
nsually black.

B. Jaws each with a conspicuous, broad, straight-edged, horny plate; teeth 45, stout, bluntish, hooked, and short.

Acrochilus, 72.

BB. Jaws without horny plate.

C. Teeth 6-6, strongly compressed, knife-shaped; pseudobranchiæ none; rudimentary caudal rays greatly developed; scales very small.

ORTHODON, 73.

<sup>\*</sup> No progress can be made in the study of these tishes without a careful examination of the teeth. The pharyngeal bones in the smaller species can be removed by inserting a pin or a hook through the gill-opening, under the shoulder-girdle. The teeth should be carefully cleaned with a tooth-brush, or a jet of water, or a pin, and may be examined by any small lens. In most cases a principal row of 4 or 5 teeth will be found, in front of which is sometimes a set of 1 or 2 smaller ones. The two sides are not always symmetrical. "Teeth 4-4" indicates a single row of 4 on each pharyngeal bone. "Teeth 2, 4-5, 1" indicates 2 rows of teeth on each side—on the one side 4 in the principal row and 2 in the lesser, on the other side 5 in the main row and 1 in the lesser. In the Lewiseine genera these teeth, or the principal ones, are raptatorial, that is, hooked inward at their tips. A grinding or masticatory surface is an excavated space or groove usually at the Base of the hook. A flattened or bevelled edge sometimes simulates a masticatory surface, and in some of the species the grinding surface is very narrow and confined to but one or two of the teeth. In all cases where the number of teeth is given in the specific descriptions following, this number has been verified on typical examples either by Professor Cope or the writers.

DD. Lateral line incomplete; anal basis short; scales minute.

CCC. Teeth 4-4: dorsal fin nearly median.

FF. Scales larger, 35-60 in the lateral line.

CC. Teeth 5-5 or 4-5; pseudobranchiæ present; dorsal fin inserted poste-

D. Lateral line complete: rudimentary candal rays numerous: anal basis

E. First (rudimentary) ray of dorsal slender, firmly attached to the first

F. Scales very small, 85-90 in the lateral line, which is complete.

riorly.

cies).

elongate.. LAVINIA, 74.

developed ray.

Chrosomus, 75.

Zophendum, 76.

EE. First (rudimentary) ray of dorsal somewhat enlarged and blunt. connected by membrane with the first developed ray. ## Intestinal canal short, less than twice the length of the body; teeth hooked, the grinding surface, if present, narrow or rudimena tary: peritoneum usually pale. § Dentary bones parallel, united for their whole length. (Exoalossina.) I. Premaxillaries not protractile; mandible with a conspicuous fleshy lobe on each side at base. Exoglossum, 81. §§ Dentary bones arched, free from each other, except at the symphysis. (Leuciscina.) J. Abdomen behind ventral fins not compressed to an edge, the scales passing over it; anal basis generally short. K. Teeth in the main row 4-4. L. Maxillary without barbels. M. Jaws each with a hardened bony sheath; first ray of dorsal spine-like, connected by membrane with the first developed ray; teeth 4-4. Cochlognathus, 82. MM. Jaws without bony sheath. N. Lower jaw with the lip thin or obsolete, not developed as a fleshy lobe on each side at base. O. Mandible, interopercle, and suborbital not cavernous. P. Teeth 4-4, or 1, 4-4, 1 (1, 4-4, 2 in one spe-

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147
                                        R. Lateral line incomplete.
                                                                Hemitremia, 83,
                                        RR. Lateral line complete ... CLIOLA, 84.
                                    PP Teeth 2, 4-4, 2,
                                          S. Lateral line complete. MINNILUS, 85.
                                          SS. Lateral line incomplete: scales
                                                          small.Protoporus, 86.
                                  OO. Mandible, interopercle, and suborbital with
                                                          conspicuous, externally
                                                          visible, cavernous cham-
                                                          bers; teeth 1, 4-4, 0.
                                                                  ERICYMBA, 87.
                                NN. Lower jaw with the lip developed as a fleshy
                                                          lobe on each side: teeth
                                                          4-4; dorsal anterior.
                                                               Phenacobius, 88.
                            LL. Maxillary with a small barbel at its extremity.
                                              U. Premaxillaries not protractile;
                                                          teeth 2, 4-4, 2; scales
                                                          small: dorsal posterior.
                                                                Rhinichthys, 89.
                                              UU. Premaxillaries protractile.
                                                V. Teeth 4-4, or 1, 4-4, 1, or 1, 4-4, 0.
                                                  W. Scales very small; dorsal
                                                          posterior.
                                                    X. Lateral line complete.
                                                                     Agosia, 90.
                                                    XX. Lateral line incomplete.
                                                                    Агосоре, 91.
                                                  WW. Scales large; dorsal me-
                                                          dian: lateral line com-
                                                          plete.
                                                              CERATICHTHYS, 92.
                                                VV. Teeth 2, 4-4, 2.
                                                      Y. Head convex above;
                                                          teeth without grinding
                                                          surface.. Couesius, 93.
                                                      YY. Head flattened above;
                                                           teeth with grinding sur-
                                                          face...Platygobio, 94,
                           KK. Teeth in the main row 5-5 or 4-5.
                                                        Z. Maxillary with a bar-
                                                          bel; premaxillaries pro-
                                                           tractile.
a. Teeth hooked, none of them molar; teeth in the lesserrow 2.
 b. Candal fin symmetrical, its rudimentary basal rays not greatly developed.
   c. Barbel minute, lateral; teeth without grinding surface.......Semotilus, 95.
    cc. Barbel terminal; teeth with grinding surface......Symmetrurus, 96.
  bb. Caudal fin unsymmetrical, the upper lobe much the longer, the basal caudal
                           aa. Teeth partly molar, much enlarged, obtusely truncate, lesser row with 2 teeth;
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ZZ. Maxillary without

barbel.

d. Upper jaw not protractile; 2 or 3 teeth modified, molar; teeth 2, 5-5, 2, or 2,  dd. Upper jaw protractile; teeth not molar.

e. Teeth two-rowed, 2 teeth in the lesser row.

- f. Lateral line complete.
  - g. Teeth subconical, scarcely hooked, sharp-edged, wide apart, the long limb of the pharyngeal bone clongate.

Ртусносингя, 100.

- gg. Teeth compressed, close-set, strongly hooked; the pharyngeal bone of the usual form.

  - hh. Caudal peduncle stout; basal rudiments of caudal little developed.

    Squalius, 102.
- - Lateral line complete.

  - JJ. Abdomen behind ventral fins compressed to an edge, the scales not passing over it; and basis usually clongate; dorsal posterior.
    - i. Abdomen in front of ventrals rounded; anal basis rather long.
       i. Teeth 5-5, with grinding surface and serrate edges.

Notemigonus, 107.

- jj. Teeth 2, 5-5, 2, entire, without grinding surface Alburnus, 108.
   \*\* Dorsal fin short, posterior, with a strong spine, composed of two, the posterior received into a longitudinal groove of the anterior; inner border of the ventral fins adherent to the body; teeth hooked, without grinding surface, in two rows. (Playontering.)
  - l. Body with small scales; teeth 2, 4-4, 2; no barbels.

LEPIDOMEDA, 109.

11. Body scaleless.

minina.)

m. Maxillary without barbel; teeth 1, 4-4, 1..... Meda, 110. mm. Maxillary with a barbel; teeth 2, 5-4, 2.

Plagopterus, 111.

- \*\*\* Dorsal fin elongate; dorsal and anal fins each preceded by a serrated spine; scales large; teeth molar; species introduced. (Cy-

# 71.—CAMPOSTOMA Agassiz.

### Stone rollers.

(Agassiz, Amer. Johrn. Sci. Arts, 1855, 218: type Rutilus anomalus Raf.)

Body moderately elongate, little compressed. Month normal, the jaws with thick lips and rudiment of a hard sheath. Premaxillaries protractile; no barbel. Teeth 4-4, or 1, 4-4, 0, with oblique grinding surface and but a slight hook on one or two teeth. Air-bladder sus-

pended in the abdominal cavity, and entirely surrounded by many convolutions of the long alimentary canal, which is 6-9 times the total length of the body. Ovaries similarly enclosed in the alimentary canal. Peritoneum black. Pseudobranchiæ present. Scales moderate. Lateral line present. Dorsal nearly over ventral. Anal basis short. No spines. Herbivorous. Sexual differences very great, the males being covered with large tubercles in spring. The singular arrangement of the intestines in relation to the air-bladder is peculiar to Campostoma among all known fishes. Size moderate. (zaazý, curve; στόμα, mouth.)

### 170. C. ornatum Grd.

Body stout. Head large, blunt and heavy. Mouth large, the maxillary reaching to near the front of the large eye. Tail rather short. Coloration brilliant, precisely as in *C. anomalum*. Head  $3\frac{3}{4}$ ; depth 4. D. 8; A. 8; Lat. l. 78. Chihuahua River. (*Girard*.)

(Grd. Proc. Acad. Nat. Sci. Phila, 1856, 176; Günther, vii, 183.)

# 171. C. anomalum (Raf.) Ag.—Stone-roller; Stone-lugger.

Body stoutish, moderately compressed, the ante-dorsal region becoming swollen and prominent in the adult. Snout moderately decurved. Scales deep, rather small and crowded anteriorly. Maxillary not reaching to opposite the front of the eye. Color brownish, with a brassy lustre above, the scales more or less mottled with dark. A dusky vertical bar behind the opercle. Dorsal and anal fins each with a dusky crossbar about half way up, the rest of the fin olivaceous in females, fiery red in the males in the spring. Iris orange in males. Males in the spring with the head and often the whole body covered with large, rounded tubercles. In no other Cyprinoid are these nuptial appendages so extensively developed. Head  $4\frac{1}{5}$ ; depth  $4\frac{2}{5}$ . D. 8; A. 7; scales 7-53-8; teeth 4-4. L. 6-8 inches. Extremely variable, the young very different in appearance from the old males. Western New York to Mexico, everywhere abundant in deep or still places in small streams, running up small brooks to spawn in spring. Herbivorous. One of the most interesting and curious of our fishes.

(Rutilus anomalus Raf. Ichth. Ob. 52: Exoglossum dubium Kirtland, Bost. Journ. Nat. Hist. v, 272: Exoglossum spinicephalum Cuv. & Val. xvii, 4-9: Chondrostoma pullum Agassiz, Amer. Journ. Sci. Arts, 1854, 357: Campostoma callipteryx, mormyrus, gobioninum, and hippops Cope, Proc. Acad. Nat. Sci. Phila. 1864, 284: Campostoma nasutum

<sup>\*</sup> Scales small, 75-80 in the lateral line; teeth 4-4 (?).

<sup>\*\*</sup> Scales moderate, 48-57.
† Teeth 4-4.

Grd. Proc. Acad. Nat. Sci. Phila. 1856, 176, from the Rio Grande, may be a distinct species (specimens before us have a slenderer head and rather more compressed and elevated body than is usual in *C. anomalum*): *Campostoma dubium* Günther, vii, 183; Agassiz, Amer. Journ. Sci. Arts, 1855, 218; Jordan, Man. Vert. ed. 2, 287.)

tt Teeth 1, 4-4, 0.

# 172. C. prolixum (Storer) Jordan & Gilbert.

Slenderer than C anomalum. Head rather shorter and narrower. Scales larger and less crowded, and the coloration more uniform and paler, or more silvery. Head  $4\frac{\pi}{5}$ ; depth  $4\frac{\pi}{2}$ . D. 8; A. 7; scales 7-49-6; teeth 1, 4-4, 0. Tennessee, Georgia, and Alabama; abundant. Very similar to the preceding, but probably worthy of specific distinction on account of the difference in dentition, constant in all specimens examined.

(Leuciscus prolixus Storer, Proc. Bost. Soc. Nat. Hist. July, 1845: Campostoma anomalum var. prolixum Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 326.)

\*\*\* Scales larger, about 45 in the course of the lateral line; teeth 4-4 (?).

### 173. C. formosulum Grd.

Head short and blunt, with broad, projecting snont. Head 4; depth 4½. D. 8; A. 7; Lat. l. 45. Grayish above, whitish below; sides more or less marmorate; a black patch at the base of the caudal and on the dorsal. San Antonio River, Texas. (Girard.)

(Grd. Proc. Acad. Nat. Sci. Phila, 1856, 176.)

# 72.—ACROCHILUS Agassiz.

### Hard-mouths.

(Aerocheilus Agassiz, Amer. Journ. Sei. Arts, 1855, 211: type Aerocheilus alutaceus Agassiz & Pickering.)

Body elongate, little compressed. Both jaws with a large, straight, horny plate, sharp externally and very conspicuous. Upper jaw protractile. No barbel. Teeth 4–5, stont, hooked, with broad masticatory surface. Intestinal canal elongate. Peritoneum black. Pseudobranchiæ present. Scales small, loosely imbricated. Lateral line present. Dorsal fin slightly behind ventrals. Anal basis moderate. Caudal fin broad, its rudimentary rays recurrent on the candal pedunele. Size rather large. ( $\check{\alpha}z\rho\sigma\varsigma$ , sharp;  $\chi z\bar{z}i\lambda \sigma z$ , lip.)

# 174. A. alutaceus Agass. & Piek.—Hard-month.

General form and appearance of the species of *Gila*, but the head not depressed, and more blunt forward. Body elongate, not much compressed, its sides more so than the caudal peduncle; the greatest depth, over the ventrals, 4 in length. Caudal peduncle very long and slender,

nearly terete, its length contained 42 times in the length of the body, its least depth 23 in its length. Head moderate, 41 in length of body, bluntish, the profile considerably rounded, the interorbital space strongly convex. Mouth horizontal, subinferior, overlapped by the broad, blunt snout, its breadth considerable, but the maxillary not extending far back, to opposite the front of the eye. Upper jaw protractile, covered with a fleshy lip, inside of which is a small, straight, eartilaginous plate, similar to that on the lower jaw, but much smaller and not evident externally. Lower lip covered with a firm cartilaginous plate, sharp externally, the upper surface being formed by its bevelled edge. The transverse width of this plate is between four and five times its (longitudinal) breadth. The plate extends in nearly a straight line from one angle of the mouth to the other; its transverse width is contained 23 times in the length of the head. Eye rather large, 53 in head,  $1\frac{3}{4}$  in snout, its position anterior and not high up,  $2\frac{1}{4}$ in interorbital space. Dorsal long, rather low, its first ray just behind the first ray of ventrals, midway between the snout and the middle of the base of the candal fin. Candal fin very long, the lobes about equal, longer than the head, widely forked, the accessory rays at is base very numerous and recurrent on the caudal peduncle; about eight of these may be distinguished on each side of the fin. Anal fin rather large; ventrals broad, reaching vent. Pectorals moderate, not reaching twothirds of the distance to the ventrals. Scales quite small, somewhat imbedded in the skin, very loosely imbricated, or often scarcely imbrieated at all, the exposed surfaces longer than high, profusely punctate; squamation quite irregular; the scales smaller on back and belly than on sides, most exposed on caudal pedancle. Lateral line much decurved. Coloration very dark, belly paler, but nearly all parts of the body studded with minute dark points. D. 10; A. 9; scales 20-85-16. Teeth 4-5, hooked, somewhat club-shaped, with a broad masticatory surface. Peritoneum black; intestines much elongate, filled in this specimen with vegetable substance. L. 12 inches. Columbia River and tributaries.

(Agassiz, Amer. Journ. Sci. Arts, xix, 214, 1855; Günther, vii, 276; Jordan, Proc. U. S. Nat. Mus. i, 83, 1878.)

### 73.-ORTHODON Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 182: type Gila microlepidota Ayres.)

Body elongate. Jaws normal, the upper protractile, the lower sharpedged, with a knob at the symphysis; no barbel. Teeth 6-6 or 6-5,

much compressed, lancet-shaped, erect, nearly straight. Upper limb of the pharyngeal bone very broad and concave, separated by a deep notch from the dentigerous portion, the bone thin and brittle. Intestinal canal elongate, about 7 times the length of the fish; peritoneum black. Scales small. Lateral line present. Dorsal fin opposite ventrals. Basal rays of caudal largely developed. Anal basis short. Pseudobranchiae none. Gill-rakers moderate, clavate, the inner edge fringed. Size large. This genus is related to *Chondrostoma*, differing chiefly in the absence of pseudobranchiae and of the horny mandibular plate.  $(\partial \rho \theta \delta z, \text{straight}; \partial \delta \omega z, \text{tooth.})$ 

# 175. O. microlepidotus (Avres) Grd.

Body elongate. Head moderate; the snout very broad; eye small, about half the length of the snout. Mouth terminal, somewhat oblique, broad, the maxillary not extending to the eye. Upper head of surface flattish, with two bony ridges. Fins rather large; the caudal strong. Coloration plain. Lateral line decurved. Head 4; depth 4½. D. 9; A. 8; scales 21–105–12; Vert. 24 + 20. Teeth 6–6 or 6–5, formed much as in Campostoma, but longer. Size large. L. 12 inches. Rivers of California; Great Basin of Utah (Yarrow).

(Gila microlepidota Ayres, Proc. Cal. Acad. Nat. Sci. i, 21, 1855; Girard, U. S. Pac. R. R. Surv. Fish. 237, fig.; Günther, vii, 275.)

### 74.-LAVINIA Girard.

(Girard, Proc. Acad. Nat. Sci. Phila, 1854, 137; type Lavinia exilicanda B. & G.)

Body elliptical, elevated, moderately compressed, rapidly contracted to the slender caudal pednncle. Head small, conical. Month moderate, terminal, oblique; the lower jaw included. Scales moderate. not closely imbricated, the exposed surfaces somewhat hexagonal. Lateral line decurved, complete. Belly behind ventrals entirely scaled. Dorsal fin well behind ventrals, its last ray just in front of the beginning of the anal, which is rather elongate. Candal fin little forked, its rudimentary basal rays much increased in number and very strong. Intestinal canal elongate, 3 times the total length of the fish; peritoneum dark. Teeth 4-5 or 5-5, scarcely hooked, cultriform, with rather broad but shallow grinding surface, the largest standing up well above the surface of the bone. Gill-rakers rather long and slender; pseudobranchiæ large. Size large. (Larinia, a classical name, without special application to these fishes.)

#### 176. L. evilicanda B. & G.

Body deep, compressed, tapering to the caudal pedancle, which is very slender. Head small, short, conical. Mouth rather small, oblique, the upper lip on the level of the lower part of the pupil, the maxillary falling short of the eye. Preorbital short and deep; suborbital moderate. Eye rather large, anterior, 4 in head. Scales rather large, 42 in front of dorsal. Dorsal fin rather small. Pectorals short. Anal high and long. Caudal well forked, its rudimental rays strong, about 10 in number. Color dark above, sides somewhat silvery. Scales with dark specks. Head  $4\frac{3}{3}$ ; depth  $3\frac{1}{3}$ . D. 10; A. 12; scales 13-64-8; teeth 4-5 or 5-5. L. 12 inches. Rivers of California.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 137; Girard, U. S. Pac. R. R. Surv. x, 241; Leuciscus exilicanda Günther, vii, 248; Lavinia harengus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 184; the same species.)

# 75.—CHROSOMUS Rafinesque, 1820.

### Red Minnows.

(Rafinesque, Ichth. Oh. 47: type Luxilus erythrogaster Raf.)

Body moderately elongate, little compressed. Jaws normal; no bar bel. Teeth 5–5 or 4–5, moderately hooked, with well-marked grinding surface. Alimentary canal elongate, about twice as long as body; peritoneum black. Scales very small. Lateral line short or wanting. Dorsal behind ventrals; anal basis short. Size small. Colors in spring brilliant. ( $\chi \rho \dot{\alpha} z$ , color;  $\sigma \dot{\omega} \mu a$ , body.)

\* Sides of the body with two black stripes; the upper running from the upper angle of the opercle straight to the caudal, sometimes breaking up in spots behind; the lower broader, extending from the snout through the eye, curved downward along the belly, and extending to the caudal, where it ends in a black spot (these stripes faint in the female).

# 177. C. crythroguster Agassiz.—Red-bellied Dace ...

Body oblong, tapering each way from the middle, little compressed. Head moderate, rather pointed. Mouth moderate, terminal, oblique, the jaws about equal. Fins rather small; the dorsal and anal high and short; caudal long. Scales quite small, firmly attached, but not much imbricated. Lateral line developed less than half the length of the body. Color brownish olive, with a dusky dorsal line and often some blackish spots; two black lateral bands as above described; between these a bright, silvery area. Belly below the lower band abruptly silvery. Females obscurely marked. Males in spring with the belly and the interspace between the lateral bands bright scarlet; bases of the vertical fins also scarlet. In high coloration the body is everywhere

minutely tuberculate and the fins are bright yellow. Head 4; depth 4. D. 7; A. 8; scales 16-85-10; teeth usually 5-5. L. 2-3 inches. Pennsylvania to Dakota and Tennessee; abundant in small streams; one of the most beautiful of our fishes.

(Luxilus or Chrosomus crythrogaster Raf. Ichth. Oh. 1820, 47: Luxilus crythrogaster Kirt. Bost. Johrn. Nat. Hist. iv, 23, fig. 1844; Cope, Cypr. Penn. 391: Leuciscus crythrogaster Günther, vii, 247; Jordan, 302.)

\*\* Sides of body with the upper band beginning opposite the vent and extending backward to the middle of the caudal, terminating in a black spot; lower band extending from snout through eye, downward and backward, ceasing at base of anal; back with dark spots and cross-bars.

### 178. C. oreas Cope.

Form of the preceding, the snout rather more obtuse. Coloration similar to that of the preceding, except for the difference in pattern. The back clear olive-green, with dark cross-bars; belly, interspace between the lateral bands, and bases of vertical fins bright crimson; fins otherwise yellow. Head 4; depth 4½. D. 8; A. 8; Lat. l. 67; teeth 5–5. L. 2½ inches. Tennessee and Roanoke Rivers; even more brilliant than the preceding.

(Cope, Journ. Acad. Nat. Sci. Phila. 1868, 233.)

\*\*\* Body with two black lateral bands on the side, which unite on the caudal pedunele, the lower broader, decurved, the upper narrow and straight.

#### 179, C. eos Cope.

Slenderer than the preceding; the lateral line less distinct, often entirely wanting. Variations in color as in the other species. Head 4; depth 5. D. 8; A. 8; Lat. l. 77; teeth 5-5. L. 2½ inches. Susquehanna River. Perhaps a variety of *C. erythrogaster*.

(Cope, Proc. Acad. Nat. Sci. Phila. 1861, 523; Cope, Cypr. Penn. 391.)

#### 76.-ZOPHENDUM Jordan.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 786, 1878: type Hyborhynchus siderius Cope.)

This genus is very closely related to *Hybognathus*, differing only in the small size of the scales, there being 55-90 in the course of the lateral line. The physiognomy is somewhat different, and the dorsal fin is inserted more posteriorly than usual in *Hybognathus*. As in *Hybognathus*, the teeth are 4-4, scarcely hooked, with narrow grinding surface, and the intestinal canal is elongate, the peritoneum black. Rocky Mountain region; one species in Western Mexico.\* (ζόφως, darkness; ἔνδον, within; in allusion to the black peritoneum.)

\* Scales very small, 85-90 in the course of the lateral line.

<sup>\*</sup>Z. australe Jordan. Body rather elongate, formed much as in Campostoma anomalum, somewhat compressed, the back somewhat elevated and rounded anteriorly. Head rather large, slightly depressed above. Mouth moderate, low; the lower jaw

# 180. Z. siderium (Cope) Jor.

Physiognomy of Apocope. Body fusiform. Head rather small, acuminate. Mouth terminal, the upper jaw the longer, maxillary reaching line of orbit. Mouth forming more than a semicircle. Lower jaw hard, less attenuate than is usual in Hybognathus. Eye small,  $4\frac{1}{10}$  in head. Fins long, the ventrals reaching anal. Color dark iron-gray above, a darker band of the same along the sides, above the lateral line, extending from the end of the snout to the middle of the caudal. Head 4; depth 4. D. 8; A. 7; Lat. l. 88; teeth 4–4. Arizona. (Cope.)

 $(Hyborhynchus\ siderius\ (lapsus\ for\ Hybognathus)$  Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 670, 1876.)

### 181. Z. plumbeum (Grd.) Jor. & Gilb.

Body rather slender. Head moderate, rounded in front. Color uniform, sometimes a black spot at the base of the candal. D. 8; A. 7; Lat. l. 58; teeth 4-4. Arkansas and Indian Territory. (*Girard.*) This species may, perhaps, be referable to *Hybognathus*.

(Dionda plumbea and spadicea Girard, Proc. Acad. Nat. Sci. Phila. 1856, 178: Hyborhynchus puniceus, Grd. I. c. 179: Dionda grisca, Grd. U. S. Pac. R. R. Surv. x, 230.)

### 77.—HYBOGNATHUS Agassiz.

(Algoma and Dionda Girard.)

(Agassiz, Amer. Journ. Sci. Arts, 1855, 223: type Hybognathus nuchalis Ag.)

Body elongate, somewhat compressed. Mouth horizontal. The jaws normal, sharp-edged; lower jaw with a slight, hard protuberance in front; no barbel; upper jaw protractile. Teeth 4-4, enltriform, with oblique grinding surface and scarcely any hook. Alimentary canal elongate, about 4 times the length of the body. Peritoneum black. Scales large. Lateral line continuous. Dorsal over ventrals. Anal basis short. Size moderate. Species numerous; mostly southwestern, and little known. (δβός, gibbons; γνάθος, jaw.)

<sup>\*\*</sup> Scales moderate, 55-60 in the course of the lateral line.

<sup>\*</sup> Body comparatively elongate, little compressed, the depth less than two-sevenths of the length.

a. Suborbital bones comparatively long and narrow.

slightly included; the premaxillary below the level of the eye; the maxillary just reaching the front of the eye. Lower jaw thin-edged, with a slight symphyseal knob. Eye small, 6 in head. Scales small. Lateral line complete, decurved. Dorsal slightly behind ventrals. Dusky bluish above; everywhere with dark points. A black spot at base of candal. Head 4; depth 4-18. D. 8; A. 7; scales 10-56-8; teeth 4-4. L. 7 inches. Lake Tupataro, Guanajuato, Mexico (west of the Sierra Madre).

<sup>(</sup>Jordan, Proc. U. S. Nat. Mas 1870 and v

### 182. H. muchalis Ag. -Silvery Minnow.

Body elongate, comparatively slender. Head moderate, rather short, the profile evenly curved. Eye large, rather longer than muzzle, about 4 in head. Upper jaw heavy; lower jaw thin. Scales large and silvery. Lateral line decurved, 12-14 large scales in front of dorsal. Olivaceous green above, translacent in life; sides clear silvery, with bright reflections. Fins unspotted. Head 4; depth  $4\frac{1}{8}$ . D. 8; A. 7; teeth 4-4; scales 5-38-4. L. 5-7 inches. A graceful minnow, abundant in most streams from New Jersey to the Upper Missouri and southward. As here defined, more than one species may be included; but, if so, the authors are unable to distinguish them.)

(Agassiz, Amer. Journ. Sci. Arts, 1855, 224; Günther, vii, 184; Hybognathus argyritis, eransi, and regius Grd. Proc. Acad. Nat. Sci. Phila. 1856, 182, 209; Hybognathus regius Günther, vii, 185; Hybognathus osmerinus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 466; Hybognathus argyritis Jordan, 289.)

### 183. II. amarus (Grd.) Jordan.

Head very short, small and blunt; front convex rather than declivons, as in *H. nuchalis*. Suborbital bones rather narrow, about as in *H. nuchalis*. Scales moderate, 16 in front of the dorsal. Coloration of *H. nuchalis*, but size much smaller. D. 8; A. 7; Lat. l. 35–38; teeth 4–4. Rio Grande region.

(Algoma amara Grd. Proc. Acad. Nat. Sci. Phila. 1856, 180.)

#### 184. II. flavipinnis Cope.

"This fish differs from H argyritis (nuchālis of the present memoir) in the smaller scales and quite different coloration. Eye large, horizontally oval, its length  $2\frac{3}{3}$  in head, and equal to interorbital width. The muzzle is shortly decurved to the mouth, which is terminal and short. The extremity of the maxillary extends half way from the end of the muzzle to the line of the orbit. Origin of ventral fins below or a little in advance of the base of the first dorsal ray. The pectoral is short, not nearly reaching the ventral, which in turn falls far short of the vent. The lateral line rises anteriorly. The occipital region is convex and rather wide, the interorbital region nearly flat. Color dusky above, a wide dusky lateral band, separated by a pale band from the back. A faint dark spot at base of caudal. Fins pale yellow, unspotted. Head  $5\frac{3}{4}$  in length, with caudal fin; depth a little more. D. 8; A. 7 or 8; scales 7-41-4. L.  $2\frac{3}{4}$  inches. Llano River, Texas." (Copc, MSS.)

### 185. II. nigrotæniatus Cope.

Similar to *H. flavipinnis*, but with larger scales. Ventral fin originating a little in advance of the first dorsal ray. Eye large, a little

less than one-third the length of the head and a little less than the interorbital width. Ventral fin nearly reaching vent. Color dusky, with a black lateral band. Fins plain. Head 5 in length, with caudal; depth the same. D. 8; A. 8; scales 5-34-3. L. 2½ inches. Medina River, Texas. (Cope, MSS.)

aa. Suborbital bones short and deep.

### 186. H. placitus Grd.

Head short and bluntish. Body stoutish. Eye small, shorter than snout, about 5 in head. Scales moderate, about 16 in front of the dorsal. Size comparatively small. Grayish above, silvery below. Head 4<sup>3</sup>; depth 4<sup>1</sup>/<sub>2</sub>. D. 8; A. 7; Lat. l. 40; teeth 4-4. Mississippi Valley to Utah. (Possibly two species are here included.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 182; Hyboquathus nuchalis Cope, Proc. Amer. Phil. Soc. Phila. 1874, 66; Hyboquathus nuchalis Jordan, 289; probably not of Agassiz.)

aaa. Suborbital bones unknown; small species of the Texan region.

# 187. H. episcopus (Grd.) Jordan.

Slender and graceful, fusiform in profile, and compressed, with the back slightly arched. The head is large, forming about the fifth of the length. Eye large and subcircular, the diameter 3½ in head. Fins moderate. Scales large, the lateral line following the middle of the flauks. Dusky above, a blackish band along the sides, ending in a dusty blotch at base of caudal. Fins unmarked. Scales with fine black dots. D. 8; A. 8; Lat. l. 39. L. 3 inches. Rivers of Texas. (Girard.) This or some very similar species occurs in Southern Illinois. (Forbes.)

(Dionda episcopa, serena, texensis, papalis, argentosa, and chrysitis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 177–178.)

### 188. II. duviatilis (Grd.) Jor.

Form, size, and coloration of *H. amarus*, but the mouth and eye smaller and the scales smaller. D. 8; A. 7; Lat. l. 40; 16 scales before dorsal. Snout tuberculate in spring males. New Leon. (*Girard*.)

(Algoma fluviatilis Grd. Proc Acad. Nat Sci. Phila, 1856, 181.)

\*\* Body short, deep, compressed, the depth about two-sevenths of the length.

# **189. II. melanops** (Grd.) Jor.

Head moderate, 4½ in length. Snout rounded. Eye medium. Blackish above; sides smoky, with black dots; a black spot at base of caudal. Depth 3½. D. 8; A. 7; Lat. l. 43; teeth 4–4. L. 2½ inches. Rio Grande region. (Girard.)

(Diouda metanops and couchi Grd. Proc. Acad. Nat. Sci. Phila. 1856, 178; Jordan, Bull. U. S. Geol. Surv. iv, No. 2, 402.)

### 78.-COLUSCUS Cope.

(Cope, Hayden's Geol. Surv. Wyom. 1872, 437: type Coliscus parietalis Cope.)

This genus differs chiefly from Hybognathus in having the lateral line incomplete or obsolete. The mouth is oblique, and the dorsal fin in advance of the ventrals. ( $z\delta\lambda o \varepsilon$ , deficiency; in allusion to the incomplete lateral line.)

# 190. C. parietalis Cope.

Body moderately elongate. Head wide, especially behind. Muzzle obtuse. Lips equal. Month descending obliquely, the maxillary not quite reaching the orbit. Eye  $3\frac{1}{3}$  in head. Scales small, the tubes of the lateral line present on 7 of them; 14 in a transverse series. Dorsal fin midway between snout and caudal. Suborbital bones slender. Coloration silvery, unspotted. D. 7; A. 8; Lat. l. 42; teeth 4-4. L. 2-3 inches. Missouri River at Saint Joseph. (Cope.)

(Cope, Geol. Surv. Terr. Wyom. for 1870, 1872, 437; Jordan, 289.)

# 79.—PINEPHALES Rafinesque.

#### Fat-heads.

(Rafinesque, Ichth. Oh. 1820, 52: type Pimephales promelas Raf.)

Body short and stout, little compressed. Head short and rounded. Mouth small, inferior; upper jaw protractile; no barbel. Teeth 4–4, with oblique grinding surface, usually but one of the teeth hooked. Dorsal over ventrals, its first (rudimentary) ray separated from the rest by membrane. Anal basis short. Intestinal canal elongate. Peritoneum black. Pseudobranchiæ present. Scales rather small. Lateral line incomplete. Size small.  $(\pi\iota\mu\epsilon\lambda\tilde{\chi}_{5}, \text{fat}; \varkappa\epsilon\varphia\lambda\tilde{\chi}, \text{head.})$ 

# 191. P. promelas Raf.—Fat-head; Black-head Minnow.

Body very short and deep. Head short, everywhere convex, almost globular in adult males. Month small, inferior, horizontal. Scales deep, closely imbricated. Lateral line almost wanting, on 5–20 scales only. Olivaceous, the dorsal with a large black bar across it, nearly half way up, most distinct anteriorly, appearing as a simple dusky shade in the young. Male fish dusky, the head jet-black, with several large tubercles on the snout in spring. A dusky shade along sides of caudal peduncle. Head 4; depth 4. D. I, 7; A. 7; scales 7–47–6; teeth 4–4. L.  $2\frac{1}{2}$  inches. Ohio Valley to the Upper Missouri; generally abundant in sluggish brooks. Varies greatly with age, sex, and season.

(Raf. Ichth. Oh. 53: Pimephales fasciatus Grd. Proc. Acad. Nat. Sci. Phila. 1856, 180: Plargyrus melanoecphalus Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 325: Pimephales

milesi Cope, Proc. Acad. Nat. Sci. Phila. 1864, 282 (from Michigan, may be a distinct species; the scales said to be Lat. 1. 40, only three series between the lateral line and the ventrals: 5-7 usually in *P. promelus*): *Pimephales agassizii* Cope, Cypr. Penn. 394; Günther, vii, 181: *Pimephales milesii* Günther, vii, 181; Jordan, 288.)

# 80.—HYBORHYNCHUS Agassiz.

(Agassiz, Amer. Journ. Sci. Arts, 1855, 222: type Minnilus notatus Raf.)

This genus differs from *Pimephales* only in having the lateral line complete. The maxillary is often provided with a rudimentary or obsolete barbel. (6β65, gibbous; β6γγοτ, snout.)

\*Angle of mouth without trace of barbel.

### 192. H. confertus Grd.

Aspect of *Pimephales promelas*. Body stout, the back moderately convex. Head wide, formed as in the preceding species. Month terminal, very small, oblique. Eye 4 in head. Fins small. Lateral line usually wanting on some of the scales along the sides. Color essentially as in *Pimephales promelas*, the males even darker; the head black; a broad black band across the dorsal; borders of anal and border of ventrals and pectorals black; the lower fins said to be edged with white in life; body somewhat mottled. Females more clongate, plainly colored. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ . D. I, 8; A. 7; Lat. l. 43; teeth 4–4. L.  $2\frac{1}{2}$  inches. Arkansas River to the Rio Grande; abundant. This species is intermediate between *Hyborhynchus* and *Pimephales*.

(Hyborhynchus confertus (♀) and Pimephales maculosus (♂) Grd. Proc. Acad. Nat. Sci. 1856, 180: Hyborhynchus nigellus Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 671.)

# 193. H. notatus \* (Raf.) Ag.—Blunt-nosed Minnow.

Body rather elongate, not elevated, moderately compressed. Head moderate; the muzzle blunt and convex; top of the head depressed. Cheeks vertical. Mouth small, inferior, horizontal. Fins small; the dorsal moderate, the first ray distinct and spine-like in the male, slender in the female. Anal small. Caudal fin short. Scales moderate, deep, closely inbricated. Scales in front of dorsal small and erowded. Eye moderate. Color olivaceous, little silvery; sides bluish; a black spot on the dorsal fin in front, near the base; a dusky shade at base of caudal; males in spring with the black on the dorsal more extended and the head wholly black; snont with about 14 disproportionately large tubercles. Head  $4\frac{1}{2}$ ; depth 5. D. I, 8; A. 7; scales 6–45–4; teeth 4–4. L. 4 inches. New York to Arkansas; generally abundant.

(Minuilus notatus Raf. Ichth. Oh. 47; Günther, vii, 182; Jordan, 288: Catostomus

<sup>\*</sup>Specimens agreeing closely with this species, but having the intestines no longer than the body (as in *Cochlognathus*), have been lately sent us from Illinois River by Professor Forbes.

melanotus Raf. Iehth. Oh. 58: Hyborhynchus perspicuus Grd. Proc. Acad. Nat. Sci. Phila. 1856, 185: Hybognathus perspicuus Günther, vii, 185.)

\*\*Angle of mouth with a minute, thickish barbel.

### 194. H. superciliosus Cope.

Head broader, more ridged above. Caudal and anal fins more dusky; otherwise like the last, from which it may be distinguished only by the presence of the small barbel. With the last, equally widely distributed, and even more abundant. Probably a variety.

(Cope, Journ. Acad. Nat. Sci. Phila. 1868, 234; Jordan, 289.)

# S1.—EXOGLOSSUM Rafinesque.

Cut-lips.

(Rafinesque, Journ. Acad. Nat. Sci. Phila. i, 420, 1818: type Exoglossum lesueurianum Raf.—Cyprinus maxillingua Le S.)

Body moderately elongate, little compressed. Mouth peculiar, the mandible being contracted and incurved, its outline strongly threelobed. This appearance is due to the fact that the dentary bones lie close together, parallel, and are united throughout their length, instead of forming a broad arch, as in all other Cyprinoid fishes. The lower lip is represented by a broad fleshy lobe on each side of the mandible. Upper jaw not protractile. Upper lip thick, somewhat plicate. Pharyngeal bones small. The teeth hooked, without grinding surface, 1, 4-4, 1. Scales moderate. Lateral line complete. Fins without spines. Dorsal slightly behind ventrals. Anal rays 7-8. Isthmus broad. Gill-rakers weak. Pseudobranchiæ present. Air-bladder normal. Alimentary canal short; peritoneum white. Size moderate. One of the most strongly marked genera of Cyprinide, with a single species. ( $\xi \xi \omega$ , outside: γλώσσα, tongue.)

# 195. E. maxillingua (Le Sueur) Haldeman.—Cut-lips; Stone-toter.

Body rather stout, little compressed. Head large, broad and flattish above, with tunid cheeks. Mouth moderate, slightly oblique, the end of the maxillary not reaching the line of the orbit. Upper jaw longer than lower. Scales rather crowded anteriorly, those in front of the dorsal small. Color olivaceous; smoky or dark above; a blackish bar behind opercle, and a dusky shade at the root of the caudal in the young; fins unmarked. Head 4; depth  $4\frac{1}{2}$ . D. 8; A. 7; scales 8–53–5; teeth 1, 4–4, 1. L. 6 inches. Western New York to Virginia; abundant in the Susquehanna Basin, but not widely distributed. One of the most singular of the *Cyprinidæ*, distinguished at sight by its three-lobed lower jaw.

(Cyprinus maxillingua Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 85; Günther, vii, 188; Jordan, 308; Cope, Cypr. Penn. 1866, 360.)

# 82.—COCHLOGNATHUS Baird & Girard.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 158: type Cochlognathus ornatus B. & G.)

This genus has the general character and appearance of Hyborhynchus, the dentition and the structure of the fins being the same; the teeth, however, rather more strongly hooked and with deeper grinding surface. It differs in the structure of the jaws, which are provided each with a hard cutting plate, to all appearance precisely like the Diodontida, the sharp bony edge being surrounded by the usual lip. First ray of dorsal separated by membrane, and spine-like, as in Hyborhynchus and Pinephales. Alimentary canal short. Peritoneum white. Pseudobranchiæ present. Lateral line complete. Anal fin small.  $(z\acute{\alpha}\chi\lambda\sigma_{5}, shell; \gamma\nu\dot{\alpha}\theta\sigma_{5}, jaw; the covering of the jaws being hard, like shell.)$ 

# 196. C. ornatus Baird & Girard.—Hard-mouth Minnow.

Appearance, dorsal fin and coloration essentially as in *Hyborhynchus notatus*. Body moderately elongate. Head rather long. Scales comparatively large. Dorsal fin over the ventrals, rather high. Anal fin quite small. Caudal fin short. Dorsal fin with a black spot near the base in front and a dusky blotch behind. The dorsal spine conspicuous. Caudal fin with a dusky median band, in front and behind which is a pale area. A dusky lateral band. Shout tuberculate in spring males, as in *Hyborhynchus*. Head 4; depth  $4\frac{1}{4}$ . D. 8; A. 6; Lat. l. 40; teeth 4-4. L. 3 inches. Rio Grande. A singular little fish, with the month resembling that of *Chondrostoma* or *Acrochilus*, but the structure otherwise resembling neither.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila, 1854, 158; Günther, vii, 187.)

### 197. C. biguttatus Cope.

"A fish of rather uniform diameter and deep caudal peduncle. The head is oblong and rather wide above. The muzzle has a decurved profile and terminal mouth. The orbit is large,  $3\frac{2}{5}$  in head, a little less than muzzle and than interorbital space. Head wide behind and flat above. The infraorbital bones are narrow, while the preorbital is large, with convex inferior and concave superior border. Maxillary not quite reaching line of orbit. Ventral fins inserted epposite second or third dorsal ray, reaching to vent. Anal fin small. Pectorals reaching three-fifths to ventrals. Color silvery, without dark markings, except a black spot at the base of the caudal and on the anterior rays of the dorsal. Head 5 in length, with the caudal fin; depth a little less. D. 8; A. 7; scales 7-34-? L.  $2\frac{1}{2}$  inches. Trinity River, Texas." (Cope, MSS.)

Bull, Nat. Mus. No. 16-11

## 83.-HEMITREMIA Cope.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 462: type Hemitremia vittata Cope.)

Body moderately elongate. Mouth normal. No barbel. Teeth 4-4 (4-5 or 5-5), hooked, with grinding surface. Scales large. Lateral line incomplete. Dorsal fin slightly behind the ventrals. Anal basis short. Species of small size. The typical species, of which but a single specimen is known, has the teeth 4-5; the normal number is probably 4-4. however, as in the other species. If, however, the teeth in *H. rittata* are permanently 5-4, the remaining species may stand under the generic name of *Chriope.*\*  $(\hat{\gamma}\mu i, \text{half}; \tau \rho \hat{\chi} \mu a, \text{pore.})$ 

\* Teeth 4-5? (Hemitremia.)

### 198. II. vittata Cope.

Body stout. Head very short, the muzzle obtuse. Month small, oblique, the maxillary not reaching the orbit. Eye large,  $3\frac{1}{2}$  in head, equal to length of muzzle. Dosal fin beginning a little behind the ventrals. Lateral line developed for about half the length. Coloration dark, a dark lateral band, above this a pale shade, the belly pale. Head  $4\frac{1}{5}$ ; depth  $4\frac{1}{2}$ . D. 8; A. 7; scales 6–38–4; teeth 5–4 (or 5–5). L.  $2\frac{1}{4}$  inches. Holston River. (*Cope.*)

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 462.)

\*\* Teeth 4-4. (Chriope Jor.)

### 199. II. bifremata Cope.

Body rather slender, the caudal peduncle somewhat contracted. Head moderate, the muzzle very obtuse. Mouth oblique, the jaws about equal. Upper lip opposite lower part of pupil. Eye large, 3 in head, longer than muzzle. Lateral line developed for a very short distance only. Thirteen scales before dorsal. Straw-colored, the scales brownedged above. A shining black band from snout through eye to caudal. An orange band above this on the snout. Regions below the black band silvery. Head  $4\frac{1}{5}$ ; depth  $4\frac{1}{5}$ . D. 8; A. 7; scales 5–36–3; teeth 4–4. L.  $1\frac{1}{2}$ –2 inches. Massachusetts to Maryland. A small but very handsomely colored species.

(Hybopsis bifrenatus Cope, Cypr. Penn. 1866, 384.)

#### 200. II. maculata Hay.

· Body long and slender, slightly elevated at the dorsal, somewhat compressed. Head flattened above. Snout rounded. Mouth small, terminal, slightly oblique, maxillary not reaching to opposite eye. Eye

<sup>\*</sup> Chriope Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 1878, 787: type Hybopsis bifrenatus Cope.  $(\chi \rho \varepsilon i\alpha, \text{ want}; \dot{o}\pi)$ , pore.)

equal to snout, 3½ in head. Dorsal slightly behind ventrals, nearer snout than base of caudal. Lateral line with pores on 8 or 10 scales only. Straw-color; a narrow dark dorsal band, and a dark streak on each side of anal. A plumbeous lateral band, and black specks on each scale. A black spot as large as the eye at base of caudal. Head 4½; depth 5. D. 8; A. 8; scales 5–38–3; teeth 4–4, with grinding surface. L. 2½ inches. Chickasawha River, Mississippi. (Hay.)

(Hay, Proc. U. S. Nat. Mns. 1880, 505.)

### 201. H. heterodon Cope.

Body moderately stout, the back compressed and somewhat elevated. Head rather pointed, the muzzle acuminate. Mouth oblique, the lower jaw projecting, the upper lip opposite the upper rim of pupil. Maxillary extending to opposite front of orbit. Thirteen scales in front of dorsal. Eye 3 in head. Color olivaceous. A blackish dorsal band. Sides with a leaden or dusky band. D. 8; A. 8. Scales 5–36–3, the lateral line extending about half the length of the body. Teeth 4–4, often crenate. L. 2½ inches. Michigan and Wisconsin.

(.1lburnops heterodon Cope, Proc. Acad. Nat. Sci. Phila. 1864, 281: Hybopsis heterodon Cope, Cypr. Penn. 382: Lenciscus heterodon Giinther, vii, 261: Hemitremia heterodon Jordan, Man. Vert. 303.)

### 81.-CLIOLA Girard.

### Silver Fins.

(Codoma, Cyprinella, Moniana, and Hudsonius Girard; Photogenis and Hybopsis Cope; Graodus Günther; Erogala Jordan.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 192: type Ceratichtlys vigilax Bd. & Grd.)

Body ovate, oblong, or elongate, usually compressed. Month normal, usually rather small. No barbels. Scales various, commonly large, often closely imbricated. Lateral line complete, usually decurved. Dorsal fin generally more or less behind ventrals. Anal short or rather elongate. Teeth 4-4, or 1, 4-4, 0, or 1, 4-4, 1\* (1, 4-4, 2 in one species), hooked, with or without grinding surface, the edge often more or less serrate. Intestinal canal short. Peritoneum mostly pale. Males in spring usually prickly, with the fins charged with red or white pigment. A very large group of small fishes, usually brilliantly colored; abundant in all our Southern and Eastern rivers, and extending southward to Western Mexico.† All are American. (A coined name.)

<sup>\*</sup> Said to be 1, 3-3, 1 in one species, *C. cobilis*. If this be true, the latter species will form the type of a distinct genus, *Tiaroga* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 204; type *Tiaroga cobilis* Girard. (A coined name.)

<sup>†(</sup>a.) C. alta Jordan. Body moderately elongate, compressed, deep, the back somewhat elevated. Head short, somewhat depressed above, moderately pointed. Eye moderate, shorter than snout, 5-6 in head. Mouth medium, oblique, terminal,

# The species may be divided as follows:\*

§ Scales not especially deeper than long; not closely imbricated.

\* Teeth 4-4; species of small size.

- $\dagger$  Teeth with grinding surface more or less developed. (Hyborsis Cope, non Ag.)
  - (a.) Scales in the lateral line more than 45.....alta, sallai.
  - a. Scales in the lateral line 43 or 44 ......tuditana, tuarocephala, hamatura. aa. Scales in the lateral line 32-37.

speetruncula, nubila, fretensis, longirostris, straminca.
rolucella, microstoma, lineolata, missuricusis, procue.

th Teeth without grinding surface. (CLIOLA.)

- b. A black spot on anterior edge of dorsal and one at the base of the caudal.

  viailar.
- bb. No black spot on anterior edge of dorsal......chlora, nigrotaniata.

  - ## Teeth with grinding surface more or less developed. (HUDSONIUS Grd.)
    saludana, storeriana, hudsonia, enruona.
- §§ Scales deeper than long, very closely imbricated along sides of the body.

\* Teeth 4-4.

† Edges of teeth entire. (Codoma Girard.)

- ‡ Teeth with grinding surface developed......iris, jugalis.
- ## Teeth without grinding surface.
- a. Dorsal fin inserted notably behind ventrals; head very short and blunt, almost round ......vittata, ornata.
- aa. Dorsal fin inserted directly over ventrals; head moderate, subconic.

callisema.

the premaxillary on the level of the pupil, the maxillary not reaching the front of the pupil. Jaws equal. Preorbital large. Scales not closely imbricated, 19 in front of dorsal fin. Dorsal over ventrals. Caudal peduncle deep. Bluish, sides silvery, fins plain. Head 4½; depth 3¾. D. 8; A. 8; scales 8-46-4; teeth 4-4, with narrow grinding surface. Lake Tupataro, Guanajuato.

(Hudsonius altus Jordan, Proc. U. S. Nat. Mus. 1879, 301.)

(b.) C. sallwi (Gün'ther) J. & G. Caudal peduncle not quite twice as long as deep. No barbels. Sneut obtusely conical, longer than the eye, which is one-fifth the length of head. Upper jaw slightly overlapping the lower. Maxillary not extending to eye. Dorsal immediately behind ventrals. Fins short. Brownish green above, minutely dotted with black along the sides. Head 4; depth 3\frac{2}{3}. D. 7; A. 6; Lat. l. 54; teeth 4-4, long, curved, with grinding surface. Intestinal canal with few convolutions. L. 3\frac{1}{3} inches. Cuernayaca, Mexico. (Günther.)

(Ceratichthys sallæi Günther, vii, 484: Hudsonius sallæi Jordan, Proc. U. S. Nat. Mus. 1-79, 226.)

(c.) C. nigrotæniata (Günther) Jor. Body oblong, snout obtuse, convex, longer than the eye. Eye 4½ in head. Mouth subinferior, small, the upper jaw the longer, maxillary not reaching front of orbit. A black lateral band. Head 4½; 4depth 5. D. 8; A. 8; scales 6-35-3. Teeth probably 4-4, although only 2-2 are present in one of the typical examples, and none at all in the others; no evident grinding surface. L. 4 inches. Atlisco, Mexico.

(Grandus nigrotaniatus Günther, vii, 485: Cliola nigrotaniata Jordan, Proc. U. S. Nat. Mus. 1879, 235. The accidental loss of the teeth in two of the three typical examples was the occasion of the establishment of the nominal genus Grandus.)

\*The reader is advised to be cautions in the use of this key. Some characters appear in the adult only, and in other cases their presence is a question simply of degree.

## Edges of teeth more or less screate or crenate; dorsal slightly behind ventrals (Moniana Girard).

gibbosa, forbesi, leonina, Intrensis, deliciosa, aurata, formosa.

\*\* Teeth 1, 4-4, 1.

b. Teeth with the edges serrate or crenate, usually without grinding surface. (Cyprinella Girard.)

- c. Dorsal fin without conspicuous black blotch on its upper posterior rays.
  - d. No conspicuous black spot at base of caudal.
    - c. Body very deep, compressed, the depth forming about a third of the length.....umbrosa, bubalina, gunnisoni.

ce. Body slenderer, the depth 31-4# in length.

suavis, lepida, billingsiana, macrostoma, ludibunda.

dd. A conspicuous black spot at base of caudal......notata, renusta.
cc. Dorsal fin elevated, with a conspicuous black blotch on its posterior
rays (often obsolete in the young).

ff. No conspicuous black spot at base of candal.

bb. Teeth with entire edges in the adult. (Erogala Jordan.)

h. Teeth with narrow grinding surface; anal short.

hh. Teeth without distinct grinding surface.

i. Anal fin short, of 8 or 9 rays.

- k. A conspicuous dark blotch on upper posterior rays of
  - Adult males with the fins chiefly red; a conspicuous black spot at base of caudal...callistia, trichroistia.

ll. Adult males without red.

m. A very conspicuous black spot at base of caudal.

stigmatura.

mm. No conspicuous black spot at base of caudal.

carulea, chloristia.

kk. No dark blotch on upper posterior part of dorsal.

zonata.

jj. Anal fin long, of 10 or 11 rays; fins high.

xænura, pyrrhomelas, hypscloptera.

§ Scales not especially deeper than long, not closely imbricated.

\* Teeth 4-4; species of small size.

†Teeth with grinding surface more or less developed.\* (Hybopsis Cope, non Agassiz.)

a. Scales in the lateral line 43 or 44.

### 202. C. tuditama (Cope) J. & G.

Form and general appearance of *Hyborhynchus notatus*. Head flat above. Muzzle very obtuse. Mouth small, inferior, horizontal. Fins low. Scales rather small, 27 in front of the dorsal. Olivaceous above; dorsal scales narrowly black-edged; no vertebral band; sides and below silvery; usually a dusky band along sides, ending in a dark caudal

<sup>\*</sup>Several of the species in this section are of doubtful validity, and some of them may prove to belong to Hyboguathus.

spot; a dark spot near the base of the dorsal in front, as in *Hyborhyn-chus*. Head 4½; depth 5. D. 8; A. 7; scales 7-44-4; teeth 4-4, little booked. L. 3 inches. Michigan to Indiana.

(Hybopsis tuditanus Cope, Trans. Amer. Phil. Soc. Phila. 1863, 381: Leuciscus tuditanus Günther, vii, 259.)

# 203. C. taurocephala (Hay) J. & G.—Bull-head Minnow.

Body stout, somewhat compressed, broad and flat above, with deep caudal peduncle. Head broad and flat above, with an angle at the temporal region. Muzzle broad and obtuse, less truncate than in Hyborhynchus notatus. Mouth rather small, horizontal, terminal, the jaws about equal, maxillary not reaching to opposite anterior margin of eye. Eye large, 3½ in head. Dorsal inserted above ventrals, nearer snout than caudal. Scales before dorsal small, in about 27 series. Dusky yellowish; sides silvery, with an obsolete dark lateral band, which terminates in a black spot; a black spot on anterior rays of dorsal fin. Depth 4½; head 4½. D.8; A.7; scales 8-43-4; teeth 4-4, with grinding surface. L.3 inches. Chickasawha River, Mississippi.

(Alburnops taurocephalus Hay, Proc. U. S. Nat. Mus. 1880, 503.)

# **204. C. hæmatura** (Cope) J. & G.

Head moderate, the muzzle little obtase. Mouth larger, terminal, oblique, the maxillary reaching the orbit. Eye 3½ in head; temporal region rounded. Scales rather small, 21 rows in front of the dorsal. Lateral line slightly decurved. Plumbeous above; head blackish; a faint dusky lateral band, ending in a dusky spot at root of caudal fin; caudal fin dull red; fins otherwise plain. Head 4; depth 4½. D. 8; A. 7; scales 7–44–4; teeth 4–4, little hooked. L. 3 inches. Michigan to Illinois; not very common.

(Hybopsis hamaturus Cope, Cypr. Penn. 382, 1836: Leuciscus hamaturus Günther, vii, 259.)

aa. Scales in the lateral line 32-37,

# 205. C. spectruncula (Cope) J. & G.

Body elongate. Head large and rather flat, nearly as broad as deep Eye large, 3 in head. Muzzle remarkably thick. Mouth slightly oblique, the maxillary reaching the eye. Fifteen rows of scales in front of dorsal. Olivaceous, silvery white below; a leaden band along the sides and a conspicuous black spot at base of caudal; head dusky; margins of scales above lateral line, as well as bases of dorsal and anal fins, blackish; pectorals, ventrals, dorsal, and anal more or less orange in

life. Head 4; depth 5½. D. 8; A. 9; Lat. I. 37; teeth 4–4. L. 3 inches. Headwaters of Holston River. (Copc.)

(Hybopsis spectrunculus Cope, Journ. Acad. Nat. Sci. Phila. 1868, 231.)

# 206. C. nubila (Forbes) J. & G.

Head narrow. Month inferior and horizontal. Lateral line anteriorly deflexed. Eye large, 3 in head, rather longer than muzzle. Fourteen scales before dorsal. Color very dark; a dark lateral band from muzzle to base of candal; fins all plain. Head 4½; depth 4. D. 8; A. 9; scales 5-37-3; teeth 4-4, little hooked. L. 2¼ inches. Rock River, Illinois.

(Albarnops nubilus Forbes, Ball. Ills. Lab. Nat. Hist. ii, 56, 1878.)

### 207. C. fretensis (Cope) J. & G.

Body slender and compressed, resembling *Minnilus*. Head convex between orbits. Mouth quite oblique, the middle of the premaxillary being opposite the line of the pupil; maxillary not reaching to orbit. Eye 3½ in head. Seventeen rows of scales in front of dorsal. Lateral line decurved. Olivaceous; a dark median dorsal band; a plambeous silvery lateral shade; checks silvery; a dark spot at base of caudal; fins plain. Head 4; depth 5. D. 8; A. 8; scales 6-35-3; teeth 4-4. L. 2½ inches. Michigan to Illinois.

(Hybopsis fretensis Cope, Cypr. Penn. 382, 1866.)

### 208. C. longirostris (Hay) J. & G.

Form of Ericymba buccata. Head rather small. Eye shorter than snout, 4 in head. Upper jaw rounded, considerably projecting beyond the lower jaw. Mouth rather large, horizontal, maxillary extending to opposite anterior margin of the eye. Scales large; about 12 large scales in front of the dorsal. Origin of dorsal midway between tip of snout and base of caudal, directly over ventrals. Pectorals not reaching ventrals; the latter to vent. Straw-color, with an obsolete lateral band and a narrow dorsal streak; fins dusky. Head 44. D.8; A.7; scales 4-36-3; teeth 4-4, with grinding surface. Chickasawha River, Mississippi.\*

(Alburnops longicostris Hay, Proc. U. S. Nat. Mus. 1880, 504.)

# 209. C. strammen (Cop.) J. & G.—Straw-colored Minnow.

Body moderately stout, little compressed. Head rather broad, with rounded angles. Mouth small, inferior, horizontal. Snout very obtuse. Eye large, 3 in head. Fifteen rows of scales in front of dorsal fin. Pale olivaceous; sides little silvery; usually a darker dorsal band; fins

all plain. Head 4; depth 5. Scales 5-36-4; teeth 4-4. L. 2½ inches. Ohio Valley and lake region; generally abundant in small streams. One of the most insignificant of all our fishes.

(Hybognathus stramineus Cope, Proc. Acad. Nat. Sci. Phila. 1864, 283: Hybopsis stramineus Cope, Cypr. Penn. 381.)

# 210. C. volucella (Cope) J. & G.

Body moderately stout. Head depressed, elongate, the vertex plane, the muzzle elongate. Fins more elongate than in most of the related species, the pectorals reaching the ventrals. Caudal peduncle slender. Eye 3\frac{1}{3} in head. Olivaceons, a slight dusky lateral shade; no dorsal stripe; fins plain. Head 3\frac{3}{4}; depth 4. D. 8; A. 8; scales 4-34-3; teeth 4-4. L. 2\frac{1}{3} inches. Michigan and Wisconsin.

(Hybognathus rolucellus Cope, Proc. Acad. Nat. Sci. Phila. 1864, 283: Hybopsis volucellus Cope, Cypr. Penn. 381: Leuciscus rolucellus Günther, vii, 260.)

### 211. C. microstoma (Raf.) J. & G.

Body elongate, the caudal peduncle not contracted. Mouth inferior, horizontal, small, the maxillary not reaching the line of the eye. Fins rather short. Eye large,  $3\frac{1}{2}$  in head. Fourteen scales before dorsal. Preorbital bone much longer than deep. Olivaceous, translucent; a silvery lateral band, along which is a black speck at the origin of each tube of the lateral line. D. 8; A. 7; scales 5–33–2; teeth 4–4. L.  $2\frac{1}{2}$  inches. Virginia to Kentucky.

(Minnilus microstomus Raf. Ichth. Oh. 1820, 47: Hybopsis longiceps Cope, Journ. Acad. Nat. Sci. Phila. 1868, 23L)

# 212. C. lincolata (Agassiz) J. & G.

Body slender. Head short. Muzzle obtuse. Mouth slightly oblique, the jaws equal, the maxillary reaching to eye. Lateral line slightly decurved. Olivaceous, sides silvery, with dark points along the lateral line, these especially abundant along the sides of the muzzle. Head  $4\frac{1}{2}$ ; depth  $4\frac{3}{5}$ . D. 8; A. 7; scales 6-34-4; teeth 4-4. L. 2 inches. Nebraska to Colorado. (Cope.) Osage River. (Agassiz.)

(Alburuus lincolatus Agassiz, Bull. Mus. Comp. Zoöl. 1863, 9: Leuciscus lincolatus Günther, vii, 260: Hybopsis seylla Cope, Hayden's Geol. Surv. Wyom. 1872, 438.)

# 213. C. missuriensis (Cope) J. & G.

Body stout, with large head and thick caudal peduncle. Mouth subinferior, somewhat oblique, end of maxillary reaching line of orbit. Twelve scales in front of the dorsal fin. Fins rather long. Eye large, 3 in head. Coloration very pale olivaceous; a silvery lateral band and some dusky specks at base of caudal; no dark dorsal line; fins plain. Head  $3_4^3$ ; depth  $4_4^4$ . A. 7; scales 5-31-3; teeth 4-4. L.  $2_2^4$  inches. Missouri to the Rio Grande; probably abundant.

(Hubopsis missuriensis Cope, Hayden's Geol. Surv. Wyom. for 1870, 1872, 437.)

# 214. C. procne (Cope) J. & G.

Body slender, with long candal peduncle. Muzzle obtuse. Mouth horizontal, inferior, small. Thirteen rows of scales in front of the dorsal. Depth of caudal peduncle one-fourth its length. Eye large. Olivaceous; a dark dorsal line and a plumbeous lateral band overlying black pigment; fins unspotted. Head  $4^3_4$ ; depth  $5^4_4$ . Scales 5–32–3; teeth 4–4; A. 7. L.  $2^1_2$  inches. Delaware and Susquehanna Rivers. One of the smallest of the *Cyprinidæ*.

(Hybognathus procee Cope, Proc. Acad. Nat. Sci. Phila. 1864, 279; Hybopsis procee Cope, Cypr. Penn. 355; Leuciscus procee Giinther, vii, 260.)

th Teeth without grinding surface. (Cliola.)

b. A black spot on the anterior edge of the dorsal and one at the base of the caudal.

# 215. C. vigilax B. & G.

Body subfusiform, compressed, not elevated. Head conical, bluntish. Mouth rather small, oblique, the jaws equal, the maxillary not extending to the eye. Eye moderate,  $3\frac{1}{2}$  in head. Isthmus rather broad. Fins small; the dorsal longer than high. Scales large, somewhat higher than long, 16 in a transverse series from dorsal to ventral. Color brownish; a dusky stripe composed of crowded dots along the lateral line; a black spot at base of caudal, and one on the anterior rays of dorsal. Head 4; depth  $4\frac{3}{4}$ . D. 9; A. 8; Lat. l. 36; "teeth 4–4, without grinding surface". L. 3 inches. Arkansas to Texas. (Girard.)

(Ceratichthys rigilax Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 390: Cliola rigilax, relox, and rivax Girard, Proc. Acad. Nat. Sci. Phila. 1853, 192, and in U. S. Pac. R. R. Surv. x, 257, 258. C. vivax is said to have scales "a good deal smaller", but no data are given. The types of all three are now lost.)

hh. No black spot on anterior edge of dorsal.

# 216. C. chlora Jordan.

Body slender, compressed. Head rather small. Eye large, about 3 in head, longer than snout. Mouth rather small, quite oblique, the lower jaw included when the mouth is closed, the maxillary scarcely reaching the front of orbit. Scales very large, about 12 in front of the dorsal fin; the body entirely scaly except the thoracic region. Lateral line somewhat decurved. Dorsal fin beginning directly over ventrals. Color pale; back greenish; belly white; side with a silvery band; no spots on fins and no dusky or plumbeous shading on the body, except

sometimes a small dark spot at base of caudal. Head  $4\frac{1}{4}$ ; depth 5. D. 7; A. 7; scales 4-35-3; teeth 4-4, without grinding surface. L.  $2\frac{3}{4}$  inches. Upper Missouri region.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 791, 1878.)

\*\* Teeth two-rowed.

! Teeth without grinding surface.

### 217. C. cobitis (Grd.) J. & G.

Body moderately elongate, subfusiform, compressed. Head small, subconical, depressed. Month small, terminal, oblique, without barbels, the maxillary falling far short of eye; lower jaw included. Eye moderate, high up, midway in head; isthmus very wide. Ventrals slightly in advance of dorsal. Fins all high. Lateral line nearly straight. Body olivaceous, with dusky specks above; a black spot at base of caudal. Head 4; depth 4½. D. 8; A. 7; Lat. l. 65. Teeth without grinding surface, 1, 3–3, 1, fide Girard.\* L. 2½ inches. Rio Gila. (Girard.)

(Tiaroga cobitis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 204, and U. S. Mex. Bound. Surv. Ichth. 60: Leuciscus cobitis Günther, vii, 247.)

### 218. C. Sima (Cope) Jor. & Gilb.

Body robust. Head short and broad, with short, decurved muzzle. Mouth large, oblique, the upper lip below the level of the pupil, the maxillary extending past the front of orbit. Eye moderate,  $4\frac{1}{5}$  in head. Fins large, the dorsal well behind ventrals. Coloration entirely silvery, brightest on the sides. Head  $4\frac{1}{5}$ ; depth  $4\frac{1}{5}$ . D. 8; A. 9; scales 8-35-4, 22 series in front of the dorsal fin; teeth 1, 4-4, 1. L.  $3\frac{1}{2}$  inches. Rio Grande at San Ildefonso, New Mexico. (Cope.)

(Alburnellus simus Cope, Zoöl. Lieut. Wheeler's Expl. W. 100th Mer. v, 649, 1876.)

## Teeth with grinding surface more or less developed. (Hudsonius Girard.†)

### 219. C. saludama Jor. & Brayt.

Body clongate, but less so than in *C. storeriana*, moderately compressed. Caudal peduncle long. Head large, rather heavy and gibbons forward, the muzzle rounded in profile. Eye large,  $3\frac{1}{4}$  in head. Mouth moderate, subinferior, the maxillary not reaching to the eye. Scales large, thin and loose, about 12 in front of the dorsal fin. Lateral line somewhat decurved in front. Fins rather small, pectorals not reaching to ventrals, the latter not to vent. Coloration pale olivaceous, nearly

<sup>\*</sup> If this number of teeth is normal and not merely due to accident, this species of course does not belong to Cliola.

<sup>†</sup>Girard, Proc. Acad. Nat. Sci. Phila. 1856, 210: type Clupea hudsonia De Witt Clinton. (The name from Hudson River.)

white, with traces of a plumbeous lateral streak. Head 4½; depth 4½. D. 8; A. 8; scales 5-39-3; teeth 1, 4-4, 1, two or three of the teeth obtuse, not hooked, only one or two of them showing a masticatory surface. L. 4 inches. Santee Basin, North and South Carolina.

(Alburnops saludanus Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 16, 1878.)

# 220. C. storeriana (Kirt.) J. & G.

Body elongate, considerably compressed in the adult. Head quite short. Muzzle blunt, decurved, shorter than the very large eye, which is 3 in head. Top of head flattened, somewhat concave between orbits. Greatest depth of head nearly three-fourths its length. Mouth moderate, nearly horizontal, the jaws nearly equal, the maxillary extending to the eye. Lateral line nearly straight, slightly decurved anteriorly. Eighteen scales before dorsal. Coloration very pale, sometimes a dusky spot at base of caudal, especially in the young. Sides with a broad silvery band. Pectorals not reaching ventrals, the latter not to vent. Caudal fin long, the lower lobe the longer, dusky, with a pale edge. Head  $4\frac{\pi}{4}$ ; depth 4. D. 8; A. 8; scales 5–39–4; teeth 1, 4–4, 0 or 1. L. 4–8 inches. Great Lake region to South Carolina. One of our largest minnows. Perhaps more than one species is here included, but we fail to distinguish with any certainty the Eastern amara from the lake form (storeriana), from which the above description was taken.

(Rutilus storerianus Kirtland, Proc. Bost. Soc. Nat. Hist. i, 71, 1842: Hudsonius amarus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 210: Hybopsis storerianus Cope, Cypr. Penn. 386: Leuciscus storerianus Giinther, vii, 250.)

### 221. C. hadsomia (Clinton) J. & G.—Spawn-eater.

This species scarcely differs from the foregoing except in the somewhat darker coloration, the black caudal spot being usually distinct, and in the dentition, several specimens examined having the teeth 2, 4-4, 1, instead of 1, 4-4, 0, as in the preceding. The proportions, scales, and fin-rays seem to be the same, and the form of the head and mouth do not essentially differ. Streams coastwise, New York to Virginia.

(Clupea hudsonia De Witt Clinton, Ann. Lyc. Nat. Hist. N. Y. i, 49, 1824: Hudsonius fluriatilis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 210: Hybopsis hudsonius Cope, Cypr. Penn. 386: Leuciscus hudsonius Günther, vii, 250.)

### 222. C. euryopa (Bean) J. & G.

Silvery, with a black lateral band. Eye large, 3 in head. Head  $4\frac{1}{4}$ ; depth 5. D. 8; A. 8; scales 6-38-5; teeth 1, 4-4, 1, with narrow grinding surface. Savannah River.

(Hudsonius curyopa Bean, Proc. U. S. Nat. Mus. 1879, 285.)

- §§ Scales deeper than long, very closely imbricated along sides of the body.
  \* Teeth 4-4.
  - † Edges of teeth entire. (Codoma.\*)

    † Teeth with grinding surface developed.

### 223. C. iris (Cope) J. & G.

Body deep, compressed, as in *Cyprinella*. Dorsal outline well arched. Mouth moderate, oblique, the jaws subequal. Eye moderate, 4 in head. Scales very narrowly exposed on the sides, the lateral line decurved. Seventeen rows of scales in front of dorsal fin, which is inserted behind ventrals; pectoral fin reaching ventrals; ventrals reaching anal; dorsal and caudal short. Males in spring with the snout in front tuberculate. Color bright, clear green above; a green band extending down behind operculum; head and belly vermilion-red; a large, square vermilion spot behind the green scapular stripe. Lower fins crimson; caudal vermilion; dorsal olivaceous, numarked. Females plain olivaceous and silvery. Head  $3\frac{3}{4}$ ; depth  $3\frac{1}{4}$ . D. 8; A. 9; scales 5–33–3; teeth 4–4. L.  $2\frac{1}{2}$  inches. Upper Rio Grande. The most brilliantly colored fish in New Mexico. (Cope.)

(Hypsilepis iris Cope, Wheeler's Expl. W. 100th Mer. v, 653, 1876.)

### 224. C. ingalis (Cope) J. & G.

Form stout, compressed. Back much elevated, descending steeply to the end of the muzzle. Upper jaw rather the longer, maxillary reaching beyond the front of the orbit. Eye moderate,  $4\frac{1}{4}$  in head. Pectorals nearly reaching ventrals. Sides and lower fins milky white; a dusky shade on dersal fin; a broad dark vertical bar behind head; a dusky shade on the side between ventrals and anal. The coloration, therefore, essentially that of the species of the group *Photogenis*. Head 4; depth 3. D. 8; A. 9; scales 7–34–4; teeth 4–4 (said to be 1, 4–4, 1 in young specimens), with rather narrow grinding surface. L.  $2\frac{1}{2}$  inches. Missouri River and Arkansas River. (Copc.)

(Moniana jugalis Cope, Hayden's Geol. Surv. Wyom. for 1870, 1872, 439.)

- ## Teeth without grinding surface.
  - Dorsal fin inserted notably behind ventrals; head very short and blunt, almost round.

### 225. C. vittata (Grd.) J. & G.

Body rather stont, heavy anteriorly, with long caudal pedancle; the back not arched. Head blunt and heavy, but less gibbons than in *C. ornata*. Month moderate, quite oblique, the maxillary not reaching to the eye. Eye rather small, nearly 5 in head. Scales rather small.

<sup>\*</sup>Girard, Proc. Acad. Nat. Sci. Phila. 1856, 194: type Codoma vittata Grd. (A coined name.)

Fins low. Lateral line somewhat decurved. Color dark above, below this a silvery band, and below this a dusky shade; fins in the typical specimens plain. Head 4; depth 3\frac{1}{2}. D. 8; A. 8; Lat. 1. 53. L. 3 inches. Valley of Mexico.

(Codoma rittata Girard, Proc. Acad. Nat. Sci. Phila, 1856, 195, and U. S. Mex. Bound, Surv. Jehth. 53.)

# 226. C. ornata (Grd.) J. & G.

Body stout and compressed, the head very blunt, thick, and rounded. Mouth small, nearly horizontal, the jaws equal. Eye large, anterior,  $3\frac{3}{4}$  in head. Scales deep, closely imbricated, the lateral line decurved. Dorsal a little behind ventrals. Fins all rather small. Snout prickly in the spring males. Color dark; sides with about 8 more or less conspicuous cross-bars; fins all with the middle part dusky or black, the tips milk-white, the pectorals and the anal notably so. Head  $4\frac{1}{8}$ ; depth  $3\frac{1}{6}$ . D. 8; A. 7; Lat. l. 39; teeth 4–4. L.  $2\frac{1}{2}$  inches. Chihuahua.

(Codoma ornata Girard, Proc. Acad. Nat. Sci. Phila. 1856, 195, and U. S. Mex. Bound. Surv. Ichth. 53.)

au. Dorsal fin inserted directly over ventrals; head moderate, subconic.

### 227. C. callisema Jordan.

Body rather elongate, fusiform, compressed. Head elongate, the muzzle rather blunt, projecting over the moderate-sized, oblique mouth; maxillary not reaching to opposite the eye. Eye moderate, 4½ in head. Scales firm, closely imbricated, 15 in front of the dorsal. Dorsal fin extremely high; its height in the males one fourth of the length of the body, in the females somewhat lower; its insertion almost directly over the first ray of the ventrals. In all the other similarly colored species of Cliola the dorsal is evidently behind the ventrals. Coloration brilliant, clear dark blue above, sides and below abruptly silvery; a blue lateral streak, much as in C. carulea, bounding the blue of the upper parts, the white pigment of the lower parts looking as if painted over the blue. Dorsal with a large black spot on its last rays above. Dorsal, anal, and caudal with the usual satin-white pigment at their tips; these fins otherwise of a clear, bright ferruginous orange. Females slender and dullcolored. Head 4; depth 42. D. 8; A. 8; scales 6-39-3; teeth 4-4. L. 23 inches. Oemulgee River, Georgia. An elegant fish, allied to the species of Erogala.

<sup>(</sup>Episema callisema Jordan, Ann. Lye. Nat. Hist. N. Y. 1876, 363: Codoma callisema Jordan, Bull. U. S. Nat. Mus. xii, 52.)

tt Edges of teeth more or less serrate or crenate; dorsal fin slightly behind ventrals.

(Moniana Girard.\*)

<sup>\*</sup> Girard, Proc. Acad. Nat. Sci. Phila. 1856, 199: type Lewiscus lutrensis B. & G. (A coined name.)

## 228. C. gibbosa (Grd.) J. & G.

Body extremely deep and compressed, the back much arched, espepecially anteriorly. Head short, blunt and deep, the profile continuous from the snont to the occiput without angle. Muzzle short and blunt. Eye small,  $3\frac{3}{4}$  in head. Mouth quite small, very oblique, the upper lip on the level of the pupil, the maxillary not extending quite to the orbit. Scales large, the lateral line very much decurved. Dorsal-fin well behind ventrals; lower fins rather large, the pectorals nearly reaching ventrals, the latter to vent. Bluish above; sides silvery; lower fins milky; a more or less distinct black spot between the rami of the lower jaw. Males tuberculate in spring. Head 4; depth  $2\frac{5}{6}$ . D. 8; A. 9; scales 6-34-3; teeth 4-4. L.  $2\frac{1}{2}$  inches. Rio Grande.

(Moniana gibbosa Girard, Proc. Acad. Nat. Sci. Phila. 1856, 201: Cyprinella complanata Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 3, 665, 1878.)

### 229. C. forbesi Jordan. - Forbes's Red-fish.

Body oblong, elevated, strongly compressed, the back arched. Candal peduncle rather slender. Head stout and deep, its upper outline depressed, the nape elevated, forming an angle, so that the profile is somewhat concave. Month rather large, quite oblique, the lower jaw included. Eye small, 4 in head. Lateral line strongly decurved. Thirteen scales in front of dorsal. Males profusely tuberculate in spring. Colors in life brilliant, steel-blue; the lower region silvery; the belly orange-red in the males; a conspicuous violet-colored crescent behind the shoulders, followed by a crimson crescent; fins reddish, the anal and caudal blood-red; chin without black spot. Head  $3\frac{2}{3}$ ; depth 3. D. 7; A. 8; scales 6–35–2; teeth 4–4. L.  $2\frac{3}{4}$  inches. Streams of Southern Illinois. Very near the preceding, but distinguished by the form of the profile and the coloration.

(Cyprinella forbesi Jordan, Bull. IIIs. State Lab. Nat. Hist. ii, 57, 1878.)

# 230. C. leonina (Grd.) J. & G.

Body rather short and deep, compressed, with long caudal peduncle. Head moderate, the snout subconical, moderately pointed. Month rather large, oblique, the maxillary scarcely extending to the orbit. Eye moderate, 4 in head. Lateral line decurved. Head  $4\frac{1}{8}$ ; depth  $3\frac{1}{2}$ . D. 9; A. 9; Lat. I. 40. L.  $3\frac{1}{4}$  inches. Rivers of Texas and Northern Mexico. (Girard.)

(Moniana leonina, complanata, and frigida Girard, Proc. Acad. Nat. Sci. Phila. 1856, 199, 200.)

# 231. C. Intrensis (B. & G.) J. & G.

Body rather short and thick-set, the back not greatly arched. Head rather heavy, the muzzle blunt. Mouth moderate, the jaws equal, the maxillary not reaching orbit. Lateral line decurved. Head 3½; depth 3½. D. 7; A. 9; Lat. I. 36; 12 scales in a transverse series. Arkansas and Red Rivers. (Girard.)

(Leuciscus lutrensis Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 391: Moniana lutrensis and pulchella Girard, Proc. Acad. Nat. Sci. Phila. 1856, 199, 200: Leuciscus lutrensis Giinther, vii. 258.)

# 232. C. deliciosa (Grd.) J. & G.

Body elliptical, moderately compressed. Head shortish, rather blunt, the profile forming an even curve. Month moderate, oblique, the maxillary not reaching to the eye. Lateral line somewhat decurved. Eye moderate,  $3\frac{1}{2}$  in head. Scales rather large. Head 4; depth  $3\frac{1}{2}$ . D. 8; A. 8; Lat. l. 33. L.  $2\frac{1}{2}$  inches. Streams in the Rio Grande region. (Girard.) More than one species may be here included, but, if so, they cannot be recognized from Dr. Girard's descriptions. Of all of Girard's Monianæ the types of only lutrensis and proscrpina can now be found.

(Moniana deliciosa, proscrpina, latabilis, conchi, rutila, nitida, and gracilis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 199-201.)

### 233. C. anrata (Grd.) J. & G.

Body subfusiform, compressed, little elevated. Caudal peduncle rather slender. Head rather blunt and heavy. Mouth small, oblique, the upper jaw projecting, maxillary not reaching to the eye; upper lip below the level of the pupil. Lateral line little decurved. A dusky streak along sides. Head  $3\frac{3}{4}$ ; depth 4. D. 8; A. 8; Lat. I. 37. L.  $2\frac{1}{2}$  inches. Piedrapainte, New Mexico. (Girard.)

(Moniana aurata Grd. Proc. Acad. Nat. Sci. Phila, 1856, 200.)

# 234. C. formosa (Girard) J. & G.

Body elliptic, compressed. Head small, rather slender and pointed. Mouth moderate, oblique, the maxillary barely reaching orbit; upper lip on the level of the pupil. Eye large, 4 in head. Lateral line decurved. Scales small. Dorsal fin rather high. Head  $4\frac{1}{8}$ ; depth  $3\frac{3}{4}$ . D. 8; A. 9; Lat. l. 49. L.  $2\frac{1}{4}$  inches. Rio Mimbres, Mexico. (Girard.) If we may trust Girard's figure, this species is well distinguished by the small size of the scales.

(Moniana formosa Girard, Proc. Acad. Nat. Sci. Phila. 1856, 201.)

### \*\* Teeth 1, 4-4, 1,

- b. Teeth with edges more or less serrate or crenate (usually without grinding surface). (Convinctla Girard.\*)
  - c. Dorsal fin without conspicuous black blotch on its upper posterior rays.
     d. No conspicuous black spot at base of caudal.
    - Body very deep, compressed, the depth forming about a third of the length.

### 235. C. mmbrosa (Grd.) J. & G.

Body short, the back very much arched. Caudal peduncle robust. Head short and deep, bluntish. Eye large, 4 in head. Mouth moderate, quite oblique, the jaws about equal, the maxillary nearly reaching the front of the eye; the upper lip on the level of the pupil. Lateral line decurved. Fins rather low. Coloration plain in spirits. Head  $4\frac{1}{8}$ ; depth 3. D.8; A.9; scales 8-42-5. L. $3\frac{1}{2}$  inches. Arkansas, etc. (Girard.)

(Cyprinella umbrosa Girard, Proc. Acad. Nat. Sci. Phila, 1856, 197, and U. S. Pac. R. R. Surv. x, 266.)

# 236. C. bubalina (B. & G.) J. & G.

Form of the preceding, but the caudal peduncle slender. Eye large, 3½ in head. Jaws equal. Lateral line decurved. This species appears to differ from the preceding chiefly in its larger scales. Head 4; depth 3. D. 8; A.9; scales 6-36-3. L. 3 inches. Red River, Arkansas. (Girard.)

(Leuciscus bubalinus B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 391: Cyprinella bubalina Girard, U. S. Pac. R. R. Surv. x, 265: Cyprinella beekwithi Grd. Proc. Acad. Nat. Sci. Phila. 1856, 267.)

### 237. C. gumnisomi (Grd.) J. & G

Body short and compressed, the back arched, but less so than in the preceding. Head small. Candal peduncle moderate. Maxillary reaching nearly to eye. Eye moderate,  $3\frac{1}{2}$  in head. Ventrals in advance of dorsal. Coloration plain in spirits. Head  $4\frac{1}{3}$ ; depth 3. D. 8; A. 9; Lat. 1. 34. L.  $2\frac{1}{2}$  inches. Cottonwood Creek, Utah.

ec. Body slenderer, the depth 31-41 in length.

### 238. C. snavis (Grd.) J. & G.

Body short, compressed, the back slightly arched. Mouth oblique. Eye 4 in head. Maxillary not quite reaching eye. Scales moderate. Lateral line gently curved. Coloration plain in spirits. "By its general form and appearance this species establishes a transition between

<sup>\*</sup> Girard, Proc. Acad. Nat. Sci. Phila. 1856; 196: type Leuciscus bubalinus Baird & Girard. (Latin cyprinella, a little carp.)

the deep and slender species." Head  $4\frac{1}{4}$ ; depth  $3\frac{1}{2}$ . D. 8; A. 9. San Antonio, Texas. (Girard.)

(Cyprinella suavis Girard, Proc. Acad. Nat. Sci. Phila, 1856, 197.)

# 239. C. lepida (Grd.) J. & G.

Body stout, fusiform. Caudal peduncle robust. Head heavy. Snont rather blunt. Mouth oblique, the maxillary not reaching quite to eye. Eye moderate, 4 in head. Lateral line decurved. Scales larger than in any of the preceding. Colors plain in spirits. Head  $3\frac{1}{2}$ ; depth  $3\frac{a}{4}$ . D. 8; A. 9; scales 6-34-4. Rio Frio, Texas. (Girard.)

(Cyprinella lepida Grd. Proc. Acad. Nat. Sci. Phila. 1856, 197, and U. S. Pac. R. R. Surv. x, 268.)

# 240. C. billingsiana (Cope) Jor. & Gilb.

Body stout, fusiform. Mouth slightly oblique, the jaws equal, maxillary reaching orbit. Eye  $3\frac{1}{2}$  in head. Dorsal considerably behind ventrals. Coloration plain in spirits. Head 4; depth 4. D. 8; A. 8; scales 6-31-3; teeth 1, 4-4, 1. L. 2 inches. Missouri River, at Saint Joseph. (*Cope.*) "Dedicated to Joshua Billings, esq., author of original observations on 'The Briny Codfish'."

(Cyprinella billingsiana Cope, Hayden's Geol. Surv. Terr. Wyom. 1870, 1872, 439.)

# **241. C. macrostoma** (Grd.) J. & G.

Body slender, the form being like that of the stouter species of *Minnilus*. Head moderate. Mouth rather large for the genns, oblique, the maxillary reaching front of eye. Eye large. Lateral line somewhat decurved. Dorsal behind ventrals. Brownish above; checks and sides bright silvery. Head 4; depth 4½. D. 8; A. 9; Lat. 1.36. Rio Grande region.

(Cyprinella macrostoma, luxiloides, and lugubris Girard, Proc. Acad. Nat. Sci. Phila. 1856, 198, 199.)

# 242. C. ludibunda (Grd.) J. & G.

Body elongate, subfusiform. Caudal peduncle slender. Eye large, 3 in head. Snout subconical. Mouth nearly horizontal, small, the maxillary not extending to the eye. Silvery; lateral line with black dots. Cottonwood Creek, Utah. (Girard.) A dubious species, apparently distinguished from the preceding by the small horizontal mouth.

(Cyprinella ludibunda Grd, Proc. Acad, Nat. Sci. Phila, 1856, 199.)

dd. A conspicuous black spot at base of caudal.

# 243. C. notata (Grd.) J. & G.

Body stoutish, subfusiform. Caudal peduncle slender. Eye moderate, 31 in head. Snout bluntish. Mouth small, oblique, the maxillary Bull. Nat. Mus. No. 16——12

not reaching to the eye. Ventrals in advance of dorsal. Fins moderate. Coloration plain in spirits, except the black caudal spot; sides silvery. Head  $4\frac{1}{3}$ ; depth  $3\frac{2}{3}$ . D.8; A.7; Lat.l.46. Rio Seco, Texas. (Girard.) (Cyprinella notata Grand, Proc. Acad. Nat. Sci. Phila. 1856, 198, and U. S. Pac. R. R.

(Cyprinella notata G.rard, Proc. Acad. Nat. Sci. Phila. 1856, 198, and U. S. Pac. R. R. Surv. x, 269.)

### 244. C. venusta (Grd.) J. & G.

Body slender, as in C macrostoma. Head long and rather pointed, the snout subconical. Mouth large, oblique, the maxillary scarcely reaching to the eye. Eye large,  $3\frac{1}{2}$  in head. Fins moderate; the dorsal behind ventrals. Coloration plain in spirits, except the caudal spot; sides mostly silvery. Head  $4\frac{1}{8}$ ; depth 4. D. 8; A. 8; scales 7–37–3 (36 in type of C texana). Rivers of Texas.

(Cyprinella renusta and texana Girard, Proc. Acad. Nat. Sci. Phila. 1856, 198, and U. S. Mex. Bound. Surv. 1chth. 54,55.)

cc. Dorsal fin elevated, with a conspicuous black blotch on its upper posterior rays (obsolete in young examples).

f. A conspicuous black spot at base of caudal.

#### 245. C. calliura Jordan.

Body elongated, compressed, elevated in the middle, the profile before the dorsal curved. Snout projecting, forming a decided angle. Head convex above, densely tuberculate in the males. Muzzle rather pointed, overhanging the oblique mouth. Eye 4 in head, less than muzzle and interorbital width. Dorsal fin inserted slightly behind ventrals. Lateral line strongly decurved, usually forming an abrupt flexure just in front of the ventrals. Color in spirits pale silvery, the dorsal and candal blotches very strongly marked. Head  $4\frac{e}{5}$ ; depth 4. D. 8; A. 8; scales 6–44–3; teeth 1, 4–4, 1. L.  $4\frac{e}{2}$  inches. Rivers of Alabama and Louisiana.

(Cyprinclla calliura Jordan, Bull. U. S. Nat. Mus. x, 61, 1877.)

ff. No conspicuous black spot at base of caudal fin. g. Teeth without grinding surface.

### 246. C. whipplei (Grd.) Jor. & Gilb.

Body moderately elongate, subfusiform. Caudal peduncle stoutish. Head shortish, rather pointed. Eye large, 4 in head. Mouth little oblique, the lower jaw included, maxillary reaching to anterior rim of the orbit; upper lip on a line with lower border of orbit. Dorsal fin very nearly opposite ventrals, greatly elevated, its height in the male more than one-fourth the length; anal fin large. Lateral line little decurved. Coloration in alcohol plain, except the conspicuous dorsal

spot; probably brilliant in life. Head 4½; depth 3½. D. 8; A. 9; scales 6-40-4. Sugar-loaf Creek, Arkansas. (Girard.)

(Cyprinella whipplei Girard, Proc. Acad. Nat. Sci. Phila, 1856, 198, and U. S. Pac. R. Surv. x, 270.)

gg. Teeth with narrow grinding surface. (Photogenis Cope.\*)

# 217. C. analostana (Grd.) J. & G.—Silver-fin.

Body moderately elongate, somewhat compressed, the dorsal and ventral outlines regularly and gently arched. Head rather short and deep. Mouth rather small, quite oblique, the lower jaw received within the upper when the mouth is closed. Eye small,  $4\frac{1}{2}$  in head. Leaden silvery, bluish in the males; edges of scales dusky; a dark vertebral line; a large black spot on the upper posterior part of the dorsal. Paired fins and lower part of belly, as well as the tips of the anal and caudal, and the front and upper parts of the dorsal, charged with clear satin-white pigment in males in the spring; in full breeding dress the dorsal pigment with a greenish lustre; no creamy band at base of caudal; males with the head and front covered with small tubercles. Head  $4\frac{1}{4}$ ; depth 4. D. 8; A. 8; scales 5–38–3; teeth 1, 4–4, 1, the edges more or less distinctly serrate. L. 4 inches. Pennsylvania and Central New York to Mississippi Valley; abundant.

(Cyprinella analostana Girard, Proc. Acad. Nat. Sci. Phila. 1859, 38: Luxilus kentuckiensis Kirtland, Bost. Journ. Nat. Hist. v, 27 (not of Raf.): Hypsilepis kentuckiensis Cope, Cypr. Penn. 371: Leuciscus analostanus Giinther, vii, 256: Photogensis spilopterus Cope, Cypr. Penn. 378: Leuciscus spilopterus Giinther, vii, 254.)

bb. Teeth with entire edges (in the adult). (Erogala Jordan.t)h. Teeth with a narrow grinding surface; anal short.

# 218. C. galactura (Cope) J. & G.-Milky-tailed Shiner.

Body fusiform, moderately clongate, not greatly compressed. Month rather large, jaws nearly horizontal, the upper projecting beyond the lower. Scales less closely imbricated than in the preceding. Lateral line little decurved. Eye small. Steel blue above, silvery below; dorsal with a black blotch on its posterior rays; caudal fin conspicuously creamy yellow at base, then dusky. Males with the belly, paired fins, and especially the tips of the vertical fins charged with milk-white pigment in the spring, the head and front then covered with small tubercles. In high coloration the anal and caudal are sometimes pale reddish. Fe-

<sup>\*</sup> Cope, Cypr. Penn. 1866, 378: type Photogenis spilopterus Cope = Cyprinella analostana Grd. (φὸς, light; γεννάω, to be born.)

<sup>†</sup>Jordan, Bull. U. S. Nat. Mus. xii, 20, 1578: type Photogenis stigmaturus Jor. (ip, spring-time;  $\gamma a \lambda a$ , milk.)

males olivaceous, obscurely marked. Head  $4\frac{1}{3}$ ; depth  $4\frac{1}{3}$ . D. 8; A. 8; scales 6-41-3; teeth 1, 4-4, 1, usually with entire edges. L. 5-6 inches. Cumberland River to Savannah River; abundant in the mountain streams. Known by its large size and the peculiar yellowish band across the caudal.

(Hypsilepis galucturus Cope, Proc. Acad. Nat. Sci. Phila. 1867, 160: Leuciscus kentuckicusis Günther, vii, 251.)

# 249. C. curystoma Jordan.

Body elongate, compressed, tapering toward the snout and the long caudal peduncle. Head moderate, larger than in *C. nivea*, rather pointed, wide on top; snout rather long. Muzzle large, quite oblique, the premaxillaries on the level of the pupil; upper jaw slightly the longer. Eye moderate,  $3\frac{1}{2}$  in head. Scales moderate, rather closely imbricated, but less so than in *C. analostana*. Pectorals not reaching ventrals, the latter about to vent; vertical fins not especially clevated. Color olivaceous, the sides bright silvery, a round black spot, nearly as large as eye, at base of caudal; dorsal blotch rather faint; dorsal fin chiefly yellowish green, ferruginous above, the extreme tip milky white; caudal fin rusty, with milk-white tips; lower fins milk-white. Snout and front in males tuberculate; minute tubercles on sides of tail. Head  $4\frac{1}{4}$ ; depth  $4\frac{1}{3}$ . D. 8; A. 8; scales 6–39–3; teeth 1, 4–4, 1, with narrow grinding surfaces, the edges of which are usually crenate. L.  $3\frac{1}{3}$ –4 inches. Chattahoochee River.

(Photogenis eurystomus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 356, exclusive of the smaller specimeus mentioned, which are Miunilus zonistius; not Codoma eurystoma Jordan, Bull. U. S. Nat. Mus. xii, 42 = Minnilus zonistius: Photogenis leucopus Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 41, 1878.)

### 250. C. nivea (Cope) J. & G.

Body regularly fusiform, the dorsal outline more arched than the ventral. Head conic. Muzzle obtuse, not projecting. Mouth nearly terminal, slightly oblique, maxillary reaching front of eye. Eye  $3\frac{1}{3}$  in head. Coloration very pale, a narrow bluish band along the caudal peduncle, forming a faint spot at the root of the caudal. Dorsal fin in the males considerably elevated, largely dusky on its last rays, the rest of the fin creamy; the tips of the dorsal, the tips of the caudal, and the whole of the anal with milk-white pigment. Males with the snout and ante-dorsal region covered with small tubercles. Head  $4\frac{1}{2}$ ; depth  $5\frac{1}{2}$ . D. 8; A. 8; scales 6–39–3; teeth 1, 4–4, 1, with narrow grinding surface. L.  $2\frac{1}{2}$  inches. Basin of the Santee, North and South Carolina.

(Hybopsis niveus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 460: Photogenis niveus Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 20.)

bb Teeth without distinct grinding surface.

- i. Anal fin short, of 8 or 9 rays.
  - k. A conspicuous dark blotch on upper posterior rays of dorsal.
    - 1. Adult males with the vertical fins chiefly red; a conspicuous black snot at base of candal.

### 251. C. callistia Jordan.

Body rather stout and compressed, rather heavy forward, the dorsal outline considerably elevated. Head stout and rather blunt, its upper part flattish; the nuptial tubercles not numerous, arranged in a few distinct longitudinal rows, not scattered without order, as in related species. Month large, nearly horizontal, slightly overlapped by the heavy snout, the maxillary reaching nearly to the eye, the premaxillaries anteriorly entirely below the level of the orbit. Eve large, 3\frac{3}{5} in head. Scales large, not very closely imbricated, 16 in front of dorsal. Fins rather large, the height of the dorsal in males nearly one-fifth of length of body. Coloration dark and brilliant. Males with the back very dark steelblue: sides a clear silvery violet; belly and lower fins satin-white. A heavy black blotch on posterior part of dorsal, extending downward and forming a horizontal bar at the base of the fin; the rest of the fin vermilion, except the milk-white tip. Candal fin bright red, yellowish at base, milky at tip; a broad golden vertebral band and a reddish lateral streak; a large, distinct, round black spot at base of caudal. Females olivaceous, with less black; the fins dull reddish. Head  $4\frac{1}{5}$ ; depth  $4\frac{3}{5}$ . D. 8; A. 8; scales 5-40-3; teeth 1, 4-4, 1. L. 4 inches. Alabama Basin. (Photogenis callistius Jordan, Ann. Lyc. Nat. Hist, N. Y. 1876, 337: Codoma callistia Jor-

dan, Bull. U. S. Nat. Mus. xii, 52.)

#### 252. C. trichroistia Jor. & Gilb.

Body rather slender, compressed. Head slender and pointed. Eye moderate, 3\frac{3}{2} in head. Mouth quite large, very oblique, the maxillary reaching the anterior margin of the eye, the premaxillaries on the level of the middle of the pupil. Lateral line considerably decurved, usually with an abrupt angulation between pectorals and ventrals. Nineteen scales before the dorsal. Fins moderate; dorsal well behind ventrals. Nuptial tubercles sparse on the head. Caudal peduncle and sides as far forward as the ventrals tuberculate in spring males. Males bright steel-blue above; sides bright white; a large black spot at base of caudal, precisely as in C. callistia; dorsal fin with a broad, dusky, horizontal band at base, the membrane of the last rays jet-black, the tip milkwhite, the rest of the fin of a bright, pale vermilion-red; caudal rosy, its tips white; anal and ventrals milky. Females duller, but the black markings distinct. Head  $4\frac{1}{8}$ ; depth  $4\frac{1}{4}$ ; scales 6-42-3; teeth 1, 4-4, 1. L.  $3\frac{1}{2}$  inches. Alabama Basin; abundant in clear streams, with the preceding and the next.

(Codoma trichroistia Jordan & Gilbert, Bull. U. S. Nat. Mus. xii, 1878, 50.)

- U. Adult males without red.
  - m. A very conspicuous black spot at base of caudal.

# 253. C. stigmatura Jordan.—Spotted-tail Minnow.

Body elongate, fusiform, compressed. Head quite long, rounded above, the snort pointed. Mouth rather large, somewhat oblique, overlapped by the narrow upper jaw. Eve small, 41 in head; iris white. Maxillary reaching beyond nostrils; premaxillary on the level of lower edge of pupil. Scales large, closely imbricated, 20 in front of the dorsal. Fins low, the dorsal rather behind ventrals, its height less than one-fifth the length of the body. Color pale, clear olive; black dorsal spot not very distinct; fins with their tips charged with satin-white pigment, otherwise plain; a very distinct, large, oblong or quadrate jetblack spot at base of caudal, the color extending up on the rays. This spot is visible on all specimens, and is larger than in any other of our Cyprinide: its length about one-third that of the head. First ray of dorsal dark in front; males with an obsolete black spot on the middle of the sides in front of the dorsal, as is often seen in Characinida, the head, etc., tuberculate in spring. Head 4½; depth 4¾. D.8; A. 8; scales 7-42-3; teeth 1, 4-4, 1. L. 43 inches. Alabama and Mississippi; very abundant. The largest species of this section of the genus and one of the most graceful.

(Photogenis stigmaturus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 337: Codoma stigmatura Jordan, Bull. U. S. Nat. Mus. xii, 52: Luxilus chicasavensis Hay, Proc. U. S. Nat. Mus. 1880, 506.)

mm. No conspicuous black spot at base of caudal.

### 254. C. cærulea Jordan.

Body fusiform, somewhat elongate, moderately compressed. Head moderate. Snout rather pointed, overlapping the small, oblique mouth, maxillaries reaching nostrils, premaxillaries below level of pupil. Eye moderate,  $3\frac{1}{2}$  in head. Scales firm, 15 in front of dorsal. Lateral line decurved. Fins all high, the height of the dorsal nearly one-fifth the length of the fish; dorsal behind ventrals. Males with the snout thickly tuberculate. Color bright steel-blue; the sides and belly silvery white; a very distinct lateral band of a bright blue-green color, most distinct posteriorly, and forming a spot at the base of the caudal fin; dorsal blotch rather faint and diffuse; tips of dorsal, anal, and

candal charged with satin-white pigment; the fins otherwise all of a clear, bright yellow. Females and young with the markings obscure, the blue lateral band usually evident. Head  $4\frac{1}{3}$ ; depth  $4\frac{3}{5}$ . D. 8; A. 8; scales 6-38-3; teeth 1, 4-4, 1. L. 3 inches. Alabama Basin.

(Photogenis cavuleus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 338: Codoma cavulea Jordan, Bull. U. S. Nat. Mns. xii, 52, 1878.)

# 255. C. chloristia Jordan & Brayton.

Body short and deep, strongly compressed, the form elliptical, as in C. pyrrhomelas, but rather deeper. Head rather small and pointed. Mouth quite oblique, the maxillary not reaching the line of the orbit, the upper jaw projecting beyond the lower, premaxillary on the level of the pupil. Eye small, less than snout, 4 in head. Lateral line decurved. Fins moderate. Nuptial tubercles covering the whole body, except the space anterior to the ventrals and below the lateral line; those on the body much smaller than those on the head. Coloration dark steel-blue; a very distinct blue stripe along each side of caudal peduncle; back clear green; lower part of sides abruptly milk-white; black dorsal blotch large, the lower part of the fin with bright pale-green pigment, the tip milky; candal dusky, its tips milky, its base pale; anal and ventrals milky, a faint dusky spot on last rays of anal; iris white. Females slenderer and less brightly colored; no caudal spot. Head 4; depth 4. D. 7; A. 8; scales 5-37-3; teeth 1, 4-4, 1. L. 3 inches. Santee Basin, Sonth Carolina.

(Codoma chloristia Jordan & Brayton, Bull, U. S. Nat. Mus, xii, 21, 1878.)

kk. No dark blotch on upper posterior part of dorsal.

# 256. C. zonata (Agassiz) Jor. & Gilb.

Physiognomy of Ceratichthys dissimilis. Body elongate, not elevated. Head elongate. Month small, nearly horizontal, the maxillary reaching beyond line of orbit, the mandible somewhat projecting. Region in front of dorsal fin more or less bare of scales. Eye large, 3½ in head. Dorsal beginning opposite ventrals, nearer snout than base of caudal. Olivaceous silvery below; a broad, silvery lateral band, with dark specks; sides of head with black specks; a dark vertebral band. Head 4; depth 4¾. D. 7; A. 8; scales 6–36–4; teeth 1, 4–4, 1. L. 3 inches. North Platte River (Cope); Osage River (Agassiz).

(Alburnus zonatus Putnam, Bull. Mus. Comp. Zoöl. i, 9, 1863: Photogenis piptolepis Cope, Hayden's Geol. Surv. Terr. Wyom. 1870, 438: Leuciscus zonatus Günther, vii, 253.)

ij. Anal fin long, of 10 or 11 rays; fins high.

### 257. C. xamura Jordan.

Body moderately elongate, subfusiform, heavy forwards. Head heavy, somewhat elongate, rounded above. Mouth large, oblique, the lower jaw included, maxillary reaching almost to orbit, premaxillary on level of upper part of pupil. Eye large,  $3\frac{3}{4}$  in head. Fins all rather low, the height of the dorsal fin, even in the males, only two-thirds the length of head; caudal fin large. Color dark steel-blue; silvery below; a faint black spot at base of caudal; scales above dark-edged. Males with the fins mostly bright crimson; the dorsal largely black at its upper posterior part; dorsal, anal, and caudal fins with white pigment; belly and bases of the lower fins likewise pigmented; head and caudal peduncle tuberculate in spring. Head 4; depth  $3\frac{3}{4}$ . D. 8; A. 10; scales 6–39–3; teeth 1, 4–4, 1. L. 3 inches. Altamaha Basin, Georgia; locally abundant.

(Minnilus xænurus Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 79: Codoma xænura Jordan, Bull. U. S. Nat. Mus. xii, 52.)

# 258. C. pyrrhomelas (Cope) J. & G.

Body deep and compressed. Head stout, rather blunt. Mouth oblique, the jaws about equal, maxillary reaching front of orbit. Eye large, 3<sup>2</sup> in head. Pectorals barely reaching ventrals, the latter to anal; dorsal fin greatly elevated, its height in the male as great as length of head; caudal very broad and long, its peduncle stout and compressed; anal fin large and long. Coloration of the males dark steelblue above; the scales darker edged; the belly abruptly milky white; head pale reddish; snout, tip of lower jaw, and iris searlet; dorsal dusky at base, the usual large black blotch above, red in front, and broadly milk-white at tip; tips of the caudal milk-white, next to this a dusky crescent, a wide crescent of bright scarlet inside of the black, extending into the two lobes of the fin; base of caudal pale; anterior region and sides of caudal peduncle with rather large tubereles. duller. Head 4; depth 33. D. 8; A. 10; scales 6-35-3; teeth 1, 4-4, 1. Santee Basin; very abundant. The most ornate of our L. 31 inches. Cyprinida.

(Photogenis pyrrhomelus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 463: Codoma pyrrhomelus Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 22, 1878.)

# 259. C. hypseloptera (Günther) J. & G.

Body short, much compressed, the back elevated. Head short, flattened above, the muzzle pointed. Mouth large, very oblique, the jaws just equal. Eye large, 3 in head, about equal to snout and to interorbital space. Scales with the exposed surfaces very narrow. Lateral line much decurved; 16 large scales before dorsal. Dorsal fin inserted entirely behind the ventrals, greatly elevated, its longest ray a little longer than head; anal fin also very high and very long, extending almost to base of caudal; these fins somewhat lower in the females. Color silvery; the dorsal blotch conspicuous; a distinct black caudal spot, smaller than eye and deeper than long; sides with a silvery band which passes around the nose, below this a dusky band. Breeding colors unknown. Head  $4\frac{1}{4}$ ; depth 4. D. 8; A. 11; scales 6–35–3; teeth 1, 4–4, 1. L.  $2\frac{1}{3}$  inches. Southern Georgia and Alabama.

(Alburnus formosus Putnam, Bull. Mus. Comp. Zoöl. i, 9, 1863 (not Moniana formosu Grd.): Leuciscus hypselopterus Günther, vii, 255: Photogenis grandipiunis Jordan, Bull. U. S. Nat. Mus. x, 62, 1877.)

# 85.-MINNILUS Rafinesque.

### Shiners.

(?? Notropis Rafinesque, 1818; Miunilus, Luxilus, and Plargyrus Rafinesque; Hypsilepis Baird; Alburnellus and Alburnops Girard; Lythrurus and Hydrophlox Jordan.)

(Rafinesque, Ichth. Oh. 1820, 47: type Minnilus dinemus Raf.)

Body oblong or elongate, more or less compressed. Month normal, mostly terminal and oblique. No barbels. Teeth 2, 4-4, 2, sharpedged or with a narrow grinding surface. Scales usually large, often closely imbricated. Lateral line complete, usually decurved. Dorsal fin inserted above, or more usually behind, the ventrals; anal fin short or somewhat elongate. Abdomen rounded. Coloration often brilliant, the males in spring usually with red fins and the head with small tubercles. A very large group of small fishes, especially characteristic of the fresh waters of the Eastern United States. Various attempts have been made to divide this group into natural genera, but the gradation from one type to another is very perfect. (English minnow; French menuise; from Latin minus, small.)

This group may be subdivided as follows:

§ Anal fin short, its rays 7-9 (sometimes 10 in M. zonistius).

\* Scales large, 35-50 in the lateral line.

†Teeth with the grinding surface more or less developed.

‡ Species attaining a large size, with the scales along the flanks nearly twice as deep as long, and so closely imbricated that the exposed surfaces are very narrow; back elevated and convex in the adult; lower jaw included; dorsal fin over ventrals (LUXLUS Raf.).

cornutus, selene.

## Species of moderate size, with the scales short and deep, but less closely imbricated than in the preceding; body elongate, not much elevated; mouth large, oblique, the lower jaw projecting; dorsal fin inserted behind ventrals .......coccogenis, zonistius.

### Species of small size, with the seales not much deeper than long, less closely imbricated; body oblong or elongate, little elevated; month moderate, oblique or horizontal; dorsal fin inserted close behind ventrals; nuptial colors mostly brilliant (Alburnops Grd.).

roscus, rubricroccus, lutipinnis, chlorocephalus, chiliticus, chalybans, chrosomus, xanoccphalus, plumbeolus, lacertosus, shumardi, blennius. tt Teeth without evident grinding surface.

a. Teeth with the edges serrate; scales closely imbricated .......eercostigma.

aa. Teeth not serrate; scales loosely imbricated, scarcely higher than long.

b. Dorsal fin inserted directly over the ventrals; anal rays 7-9; eye very large; scales large ("Episema" Cope & Jordan).

ariommus, scabriceps, jejunus, leuciodus.
bb. Dorsal inserted behind ventrals .....altipinuis, amabilis, megalops.
\*\* Scales small, about 55 in the lateral line .....bivittatus, timpanogensis.

§§ Anal fin more or less elongate, its rays 10-14.
c. Scales comparatively small, more or less closely imbricated, and with the exposed edges deep, as in *Codoma* and *Luxilus*; scales in front of dorsal small; teeth with grinding surface more or less developed. (LYTHEURUS Jordan.)

d. A black spot at base of dorsal in front.

cyanocephalus, atripes, diplamius, ardens, punctulatus. dd. A black spot at the upper anterior part of dorsal ......rubripinnis. ddd. No distinct black spot on the dorsal.

e. Body short and deep ......bellus.

f. Anal fin long, with about 14 rays ......oligaspis.

ff. Anal fin moderate, its rays 10 or 11.

g. Scales above lateral line in about 9 series ......umbratilis, gg. Scales above lateral line in 5-7 series.

h. Ventral fins reaching beyond middle of dorsal.

ecepticus, photogenis, telescopus, stilbius, percobromus, rubellus, dinemus, rubrifrons, jemezanus.

hh. Ventral fins scarcely reaching beyond front of dorsal.

micropteryx.

§ Anal fin short, its rays 7-9 (rarely 10).

\* Scales large, 35-50 in the lateral line.

†Teeth with the grinding surface more or less developed.

‡ Species attaining a large size, with the scales along the flanks nearly twice as deep as long, and so closely imbricated that the exposed surfaces are very narrow; back elevated and convex in the adult male; the lower jaw included; dorsal fin inserted directly opposite ventrals. (Luxilus Raf.\*)

260. M. COPRIIII (Mitchill) J. & G .- Shiner; Red-fin; Dace.

Body clongate in the young, in the adult short, compressed, with the anterior dorsal region much swollen and gibbous. Head rather heavy, compressed, rounded between the eyes, the snout bluntish. Mouth moderate, nearly horizontal, the jaws nearly equal, the lower somewhat included. Eye moderate, 4–5 in head, maxillary scarcely

<sup>\*</sup>Ratinesque, lehth. Oh. 1820, 47: type Luxilus chrysocephalus Raf. = Cyprinus cornutus Mitch. (From Latin lux, light = "Shiner".) (= Hypsilepis Baird.)

reaching front of eye, the premaxillaries below the level of the eye. Scales always deeper than long on the flanks, becoming extremely so in the adult. Lateral line decurved. Dorsal moderate, inserted directly over the ventrals in the young, thrown somewhat backward in the adult by the growth of the postoccipital region. Pectorals barely or not reaching ventrals, the latter about to vent. Region in front of dorsal typically with about 23 scales. Coloration dark steel-blue above: the scales with dusky edges, the bases also dusky: a gilt line along the back and one along each side, these distinct only when the fish is in the water; belly and lower part of the sides silvery, or bright rosy in spring males: dorsal fin somewhat dusky: other fins plain; the lower fins all rosy in spring males; head dark above; a dark shade behind scapula; lower jaw and region in front of dorsal to the tip of the snout covered with small tubercles in spring males; female and young fishes are plain olivaceous above and silvery below. Head 41; depth 31, varying much with age. D. 8; A. 9; scales 6-41-3; teeth 2, 4-4, 2, with rather narrow grinding surface. L. 5-8 inches. Entire region east of the Rocky Mountains excepting the South Atlantic States and Texas; almost everywhere the most abundant fish in small streams. Its variations are great. The following forms are worth distinguishing by name.

Var. gibbus Cope.

Sixteen scales before the dorsal fin. Anterior dorsal region in the males extremely short and swollen; the base of the dorsal therefore very oblique. Michigan to Kentucky; common.

(Hypsilepis cornutus gibbus Cope, Proc. Acad. Nat. Sci. Phila. 1867, 158.)

Var. fromtalis Agassiz.

Fifteen to eighteen scales in front of dorsal. Head heavy. Body less gibbons than in the preceding. Great Lake Region, etc.

(Leuciscus frontalis and gracilis Agassiz, Lake Superior, 368, 370.)

# Var. cerusimus Cope.

Sixteen scales before dorsal; scales 6-40-3. Head 4 in length. Eye large, 34 in head. Colors very brilliant, in high coloration entirely red. Roanoke River.

(Hypsilepis cornutus cerasinus Cope, Proc. Acad. Nat. Sci. Phila. 1867, 159.)

#### Var. cornectes.

Above described. The scales 22-25 in front of dorsal fin. Everywhere abundant.

(Cyprinus cornulus Mitchill, Amer. Month. Mag. i, 324; Hypsilepis cornulus Cope, Proc. Acad. Nat. Sci. Phila. 1867, 158; Plargyrus typicus and bowmani Girard, Proc. Acad. Nat. Sci. Phila. 1856, 196; Plargyrus argentatus Girard, l. c. 212; Leuciscus cornulus Günther, vii, 249; Luxilus chrysocephalus Raf. Ichth. Oh. 1820, 47.)

### Var. cyaneus Cope.

Scales of the dorsal and ventral regions very small, 31-40 in front of the dorsal fin. Scales 10-40-4. Coloration extremely dark; blue-black above; fins chiefly black. Lake Superior.

(Hypsilepis cornutus cyaneus Cope, Proc. Acad. Nat. Sci. Phila. 1867, 160.)

### 261. M. selene Jordan.

Body elongate, compressed. Head short and stout, rounded above. Mouth terminal, oblique, the lower jaw included. Muzzle blunt and short. Eye very large, 3 in head, wider than snout and than interorbital space. Dorsal fin very high. Lateral line little decurved. Bright steel-blue above, with a very distinct silvery band overlying a plumbeous shade; a dark spot at base of caudal; a dark vertebral line; cheeks, belly, and iris white; fins plain, probably red in spring. Head 4½; depth 4½. Scales 4-40-3; teeth 2, 4-4, 2. Lake Superior.

(Luxilus selene Jordan, Bull. U. S. Nat. Mus. x, 60, 1877.)

## Species of moderate size, with the scales short and deep, but less closely imbricated than in the preceding; body clongate, not much elevated; mouth large, oblique, the lower jaw projecting; dorsal fin inserted behind ventrals.

# 262. M. coccogenis (Cope) Jordan.—Red-checked Shiner.

Body elongate, compressed, not at all elevated. Head straight and rather pointed. Mouth large, very oblique, the premaxillary nearly on a level with the pupil, lower jaw projecting beyond upper, maxillary reaching past front of eye. Eye very large,  $3\frac{1}{2}$  in head. About 20 scales in front of the dorsal fin. Back olivaceous; the scales dark-edged; belly and sides silvery, rosy in spring males; a dusky scapular band; a scarlet bar like a brand down the line of the preopercle; muzzle and upper lip red; a red axillary spot; outer half of dorsal black, lower half yellowish; outer part of caudal dusky, base paler; a faint lateral streak and a dark vertebral line; lower fins white; snout swollen and tuberculate in spring males; females silvery, with only traces of red markings. Head 4; depth  $4\frac{1}{4}$ . Scales 7-42-3; teeth 2, 4-4, 2. L. 5 inches. Cumberland to Savannah Rivers; abundant in the mountain streams.

(Hypsilepis coccogenis Cope, Proc. Acad. Nat. Sci. Phila. 1867, 160: Leuciseus coccogenis Günther, vii, 253.)

#### 263. M. zomistins Jordan.

Body rather stout, compressed, the back somewhat elevated, the form that of a young *Minnilus cornutus*. Head heavy, broad and flattish above, the profile evenly descending. Mouth large, but smaller than in *coccogenis*, oblique, the jaws about equal, the upper lip opposite the

middle of the eye, the maxillary reaching the front of orbit. Eve very large, longer than shout, 33 in head. Scales not very closely imbricated: 17 scales in front of dorsal. Lateral line strongly decurved. Fins moderate, pectorals scarcely reaching ventrals. Steel-blue above; sides with considerable coppery lustre: dorsal fin with a sharp jet-black horizontal bar about half way up, reddish in young fishes, the tips of the fin somewhat milky, the base pale; a round black spot nearly as large as the eye at the base of the caudal; anal fin plain; caudal fin dull ferruginous red, pale at base as in M. coccogenis, milky at tip; back and sides with gilt lines, as in M. cornutus, the former becoming dark after death; a faint red bar down the cheeks as in M. coccogenis; a dark humeral bar; males with the snout tuberculate; females plain, so much resembling Cliola curystoma, from the same waters, that the two species have been Head  $3\frac{1}{5}$ ; depth  $3\frac{2}{5}$ . Scales 7-40-3; teeth 2, 4-4, 2, with very narrow grinding surface on one or two of them. L. 4 inches. Chattahoochee River, the typical examples from Suwannee Creek.

(Codoma eurystoma Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 42, 1878, excl. syn. (not Photogenis eurystomus Jordan): Luxdus zonistius Jordan, Proc. U. S. Nat. Mus. 1879, 239.)

### Species of small size, with the scales not much deeper than long, less closely imbricated; body oblong or elongate, little elevated; month moderate, oblique or horizontal; dorsal fin inserted close behind ventrals; nuptial colors commonly brilliant. (Alburnops Grd.\*)

#### 261. M. roseus Jordan.

Body short and stout, little compressed. Head rather short, thick, bluntly rounded. Mouth moderate, slightly oblique, the jaws about equal. Eye large, nearly 3 in head, about equal to muzzle, a little less than the broad interorbital space. Fifteen scales before dorsal fin; dorsal fin high, directly over ventrals. Olivaceous; scales dark-edged; a broad plumbeous lateral band; lips black; a dark caudal spot; a dark vertebral line; anal region dasted with dark points; checks and belly silvery; males with the dorsal, anal, caudal, and pectorals mostly rosy red; iris, top of head, and tip of snout red. Head  $3\frac{\pi}{8}$ ; depth  $4\frac{\pi}{2}$ . Scales 5–38–5; teeth 2, 4–4, 2. L.  $2\frac{\pi}{2}$  inches. Notalbany River, Louisiana.

(Luxilus roscus Jordan, Bull, U. S. Nat. Mus. x, 61, 1877.)

# 265. M. rubricroceus (Cope) J. & G.—Red Fall-fish.

Body moderately elongate, somewhat compressed. Head comparatively long and rather pointed. Mouth rather large, oblique, the jaws about equal. Eye large, as long as snout, 3½ in head, premaxillary

<sup>\*</sup> Girard, Proc. Acad. Nat. Sci. Phila. 1856, 194; type Alburnops blennius Grd. (Alburnus; ωψ, appearance.) (= Hydrophlox Jor.)

rather below pupil, maxillary reaching beyond front of orbit. Lateral line somewhat decurved. Nineteen scales in front of dorsal. Dorsal inserted somewhat behind ventrals. Females plain olivaceous. dark steel-blue, a dark lateral band of coaly punctulations, which is usually distinct on the anterior part of the body, and passes through the eye around the snout; fins all rich, clear red, the dorsal crimson, the candal pink, the lower fins scarlet; head pale red, the lower jaw flushed as if bloody; eyes bluish or flushed with red; a lustrous streak along sides; silvery below. In high coloration the whole body is more or less red. Males with the head and antedorsal region dusted with fine white tubercles. Head 4: depth 43. D. 8: A. 9: scales 7-38-3: teeth 2, 4-4, 2, the edges of the grinding surface often serrate. L. 21 inches. Headwaters of the Tennessee and Savannah Rivers. A surpassingly beautiful little fish, abounding in rock-pools at the foot of cascades.

(Hybopsis rubricroceus Cope, Journ. Acad. Nat. Sci. Phila. 1868, 231: Hydrophlox rubricroceus Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 32, 1878.)

# 266. M. Intipiamis Jordan & Brayton.

Body stout and rather strongly compressed, the dorsal region somewhat elevated, the outline of the back sloping each way from the dorsal fin. Head short and rather deep, broad and flattish above, the muzzle moderately rounded. Eye rather large,  $3\frac{2}{3}$  in head. Mouth rather large, but smaller than in the preceding, quite oblique, the maxillary reaching to orbit. Mandible included. Eighteen scales in front of dorsal. In life clear olive, with very intense green dorsal and vertebral lines; an intense metallic blackish band along sides; below this the sides are bright silvery; the whole body in the males bright, clear red, the color of red berries; fins all bright golden yellow; tip of lower jaw black. Head  $4\frac{1}{8}$ ; depth  $4\frac{1}{4}$ . D. 8; A. 8; scales 7–40–3; teeth 2, 4–4, 2. L. 3 inches. Oconee River, Georgia.

(Hydrophlox lutipinnis Jordan & Brayton, Bull, U. S. Nat. Mus. xii, 36, 1878.)

# 267. M. chlorocephalus (Cope) Jor. & Gilb.

Body stont, with deep candal peduncle. Head broad, with descending muzzle. Month oblique, the maxillary reaching beyond line of orbit, premaxillary opposite lower margin of pupil. Eye large, 3 in head. Interorbital space greater than muzzle. Lateral line moderately decurved. Sixteen scales in front of dorsal. Color olivaceous, everywhere dusted with blackish specks, which form a lateral band, which terminates in a dusky spot at base of caudal; green vertebral and lat-

eral lines; top of head and upper portion of cheeks metallic green; males with the belly dark crimson, the whole body more or less flushed; snout and antedorsal region tuberculate; fins plain. Head 4; depth 5. D. 8; A. 8; scales 6-39-3; teeth 2, 4-4, 2 (1, 4-4, 1, according to Cope, but we find 2, 4-4, 2 in numerous specimens). L. 2½ inches. Santce Basin, in North and South Carolina.

(Hybopsis chlorocephalus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 461.)

# 268. M. chiliticus (Cope) J. & G.

Aspect more chipeoid. Head broad behind. Occiput convex. Muzzle acuminate, greater than interorbital width. Eye large, 3 in head, longer than muzzle, maxillary extending beyond anterior rim of orbit, premaxillaries opposite middle of pupil. Lateral line strongly decurved. Dorsal fin small. Olivaceous; dorsal scales brown-edged; sides and below pure white; males with the lips vermilion; a vermilion band through dorsal and one through anal fin. Head 4; depth 5½. D. 8; A. 8; scales 7–36–2; teeth 2, 4–4, 2. L. 2 inches. Yadkin River, North Carolina. (Cope.)

(Hybopsis chiliticus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 462.)

### 269. M. chalybæus (Cope) J. & G.

Body moderately elongate, with rather abruptly elevated back and slender candal peduncle. Head flat above, rather narrow, muzzle rather pointed. Mouth oblique, the lower jaw rather the longer. Lateral line decurved. Eye large, 3 in head. Eighteen scales in front of dorsal. Brownish above; a broad, black, shining lateral band from muzzle to base of caudal; a light band above it on the muzzle; belly straw-colored, bright orange in spring males; fins plain. Head  $3\frac{4}{5}$ . D. 8; A. 8; scales 6–35–3; teeth 2, 4–4, 2. L. 2 inches. Delaware River, probably the smallest of the genus. (Cope.)

(Hybopsis chalybous Cope, Cypr. Penn. 1866, 383.)

### 270. M. chrosomus Jordan.

Form chubby, little compressed, the back somewhat elevated, caudal peduncle not much contracted. Head rather large, rounded above, the snout somewhat pointed. Month moderate, oblique, the upper jaw the longer. Eye 3½ in head, as long as muzzle. Scales everywhere large, 16 before the dorsal fin. Lateral line little decurved. Clear hyaline green in life, with blue reflections; belly, etc., clear silvery; a scarlet bar across dorsal, anal, and base of caudal; a narrow scarlet band from upper edge of opercles straight to caudal; below this a silvery band; a row of black dots along the lateral line, forming a small, distinct spot at

base of caudal; top of head and vertebral line golden. Snout tuberculate in males. Head  $4\frac{1}{3}$ ; depth 5. D. 8; A. 8; scales 5–37–3; teeth 2, 4–4, 2. L.  $2\frac{1}{2}$  inches. Alabama Basin; very abundant in clear streams. A graceful little fish.

(Hybopsis chrosomus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 333: Hydrophlox chrosomus Jordan & Brayton, l. c. 49.)

### 271. M. xænocephalus Jordan.

Body rather short and deep, with thick candal peduncle; back wide, not elevated. Head large, flattish and broad above, the snout rounded. Mouth large, oblique, the jaws nearly equal. Eye very large,  $2\frac{3}{4}$  in head. Lateral line somewhat decurved. Thirteen scales in front of the dorsal. Dorsal fin slightly behind ventrals. Dark olivaceous above, the scales being extensively dark-edged; a dark band along the sides of the caudal peduncle, which vanishes in black points along the sides of the body, reappearing on the head and passing around the snout; a dusky blotch at base of caudal. Males without red markings, the snout swollen and tuberculate in the spring. Head  $4\frac{1}{5}$ ; depth 5. D. 8; A. 7; scales 5–38–3; teeth 2, 4–4, 2. L.  $2\frac{3}{4}$  inches. Georgia to Mississippi.

(Hybopsis xwnocephalus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 334.)

### 272. M. plumbeolus (Cope) J. & G.

Body oblong, compressed, the back somewhat arched. Mouth oblique, the lower jaw slightly longer than the upper. Fins short. Eye large,  $2\frac{3}{4}$  in head. Silvery, with bluish reflection; top of head dusky; a dark spot at base of caudal. Head  $4\frac{1}{8}$ ; depth  $4\frac{2}{3}$ . D. 8; A. 9; scales 6–39–3; teeth 2, 4–4, 2. L. 3 inches. Saginaw River. (Cope.)

(Alburnops plumbeolus Cope, Proc. Acad. Nat. Sci. Phila, 1864, 282.)

### 273. M. lacertosus (Cope) J. & G.

Body stout. Head broad and deep. Month wide, the lower jaw projecting. Eye large,  $3\frac{1}{4}$  in head, equal to muzzle and to width of interorbital space. Maxillary not reaching the line of the orbit. Scales large, only 5 above the lateral line. Silvery; dorsal region dusky; no red. Head 4. Teeth 2, 4-4, 2. L.  $4\frac{1}{2}$  inches. Headwaters of Tennessee River. (*Cope.*)

(Hybopsis lacertosus Cope, Journ. Acad. Nat. Sci. Phila. 1868, 232.)

#### 274. M. shumardi (Grd.) Jor. & Gilb.

Body moderately elongate. Snout subconical, not strongly decurved. Mouth rather large, oblique, the lower jaw included, maxillary reaching front of eye, upper lip above the level of the lower border of eye. Dorsal over ventrals. Eye large, 34 in head. Olivaceous; sides silvery;

fins plain. Head 4; depth  $4\frac{1}{2}$ . D. 8; A. 8; scales 5-40?-3. L.  $3\frac{1}{2}$  inches. Arkansas River. (Girard.)

(Alburnops shumardi and illecebrosus Girard, Proc. Acad. Nat. Sci. Phila, 1856, 194, and U. S. Pac, R. R. Surv. x, 261, 262.)

# 275. M. blennius (Grd.) J. & G.

Body moderately elongate. Head moderate, the snout short and strongly convex, so that the mouth is nearly horizontal, the upper lip being below the level of the eye, lower jaw shorter than upper, maxillary extending beyond front of eye. Dorsal directly over ventrals, nearer snout than candal. Scales deeper than long. Lateral line decurved. Head  $4\frac{1}{4}$ ; depth  $4\frac{1}{2}$ . D. S; A. 7; scales  $6-40\frac{3}{2}-3$ . L.  $3\frac{1}{2}$  inches. Arkansas River. (Girard.)

(Alburnops blennius Grd, Proc. Acad. Nat. Sci. Phila, 1856, 194, and U. S. Pac. R. R. Surv. x, 261.)

th Teeth without evident grinding surface.

a. Teeth with the edges serrate; scales closely imbricated.

# 276. M. cercostigma (Cope) J. & G.

"Teeth 2, 4-4, 2, with sharp, serrate edges (without grinding surface)." Dorsal fin inserted 2 scales behind that above insertion of the ventrals. Dorsal line compressed, elevated, rising regularly from end of muzzle. Cranium convex above. Muzzle narrowed in proportion, slightly overhanging month. Eye 43 in length of head, 13 in length of muzzle, and 2 in interorbital width. End of maxillary opposite posterior margin of nares. Ventral outline less curved than dorsal. Candal peduncle rather stont. Isthmus narrow. Scales rather elevated, 8-39-3. Lateral line gently decurved over ventrals. Head 41 in length to origin of caudal, I seale less than depth at dorsal. The pectorals nearly reach the ventrals, and the latter attain the vent. Radii: D. 8; A. 8; the longest (anal) ray four thirds its base and three-sevenths distance to longest fulcrum at origin of caudal. Total length 43 inches. Color bright olive above, without line or spot; below and sides, from fifth row of scales above, golden silvery; all the fins, except the pectorals, with white pigment at their bases, without markings; a large, round black spot at base of candal," Pearl River, Mississippi. (Cope.) The number of teeth in the inner row as above described renders it necessary for us to refer this fish to the genus Minnilus. Its affinities, however, are evidently with Cliola, and the recorded dentition may be abnormal.

(Cyprinella cereostigma Cope, Proc. Acad. Nat. Sci. Phila, 1867, 157.)

aa. Teeth not serrate; scales loosely imbricated, scarcely higher than long.

b. Dorsal fin inserted directly over the ventrals; anal rays 7-9; eye very large; scales large. ("Episema"\* Cope & Jordan.)

<sup>&</sup>quot; Name preoccupied.

# 277. M. ariomanus (Cope) Jor.—Big-eyed Shiner.

Body stout, moderately elevated, somewhat compressed. Head heavy, broad above, the snout moderate, somewhat decurved. Mouth moderate, oblique, the jaws equal, the upper lip on the level of the pupil, the maxillary reaching the front of the eye. Eye very large,  $2\frac{3}{5}$  in head, much longer than snout, larger than in any other of the American Cyprinidæ. Fins moderate, the dorsal almost directly opposite ventrals. Scales large, 15 in front of the dorsal. Lateral line much decurved. Olivaceous; scales above dark-edged; sides and below bright silvery; no red. Head  $3\frac{3}{4}$ ; depth  $4\frac{1}{4}$ . D. 8; A. 9; scales 6-39-2; teeth 2, 4-4, 2. L. 5 inches. Ohio Valley. A handsome species.

(Photogenis ariommus Cope, Cypr. Penn. 1866, 378: Cliola ariommu Jordan, Man. Vert. ed. 2, 298.)

### 278. M. scabricens (Cope) Jor.

Body rather stout, little compressed, the back slightly elevated. Head rather short and broad, the muzzle bluntish, somewhat decurved. Mouth rather small, terminal, oblique, the maxillary reaching front of orbit. Lateral line not much decurved. Fins rather small. Eye large, 3 in head. Color plain olivaceous; scales dark-edged above; sides white, with a lateral band formed of dusky specks, this band running through the eye around the snoat. Males tuberculate in spring. Smaller than M. ariommus and less silvery. Head 4; depth 4½. D.8; A.8; scales 6-38-3; 2, 4-4, 2. Ohio Valley.

(Photogenis scabriceps Cope, Proc. Acad. Nat. Sci. Phila, 1867, 166; Cliola scabriceps Jordan, Man. Vert. ed. 2, 298.)

### 279. R. jejamus (Forbes) Jor. & Gilb.

Body rather slender. Head flattish above, the snout blunt and rounded. Mouth rather large, oblique. Eye rather large, 3\(^2\) in head, equal to snout, less than interorbital space. Dorsal over ventrals. Sixteen scales before dorsal. Color pale, with a broad silvery lateral band overlying a plumbeous shade; dorsal sometimes punctulate. Head 4; depth 4\(^2\). D. 8; A. 7; scales 5-37-3; teeth 2, 4-4, 1. L. 3 inches. Illinois River.

(Episema jejuna Porbes, Bull. His. Lab. Nat. Hist. ii, 60, 1878.)

### 230. M. Remeiodas (Cope) Jor.

Body rather slender. Muzzle rounded in profile. Mouth oblique, the mandible not projecting. Lateral line nearly straight. Twelve rows of scales in front of the dorsal fin. Olivaceous; scales above dark-edged; sides silvery, with a purple band; a black spot at base of

eandal; muzzle and base of dorsal red in the males. Head  $4\frac{1}{2}$ . D. 8; A. 8; scales 5-39-3. L. 3 inches. Holston River. (Cope.)

(Photo ienis leuciodus Cope, Proc. Acad. Nat. Sci. Phila, 1867, 165.)

bb. Dorsal inserted behind ventrals.

# 281. W. altipinzis (Cope) Jor.

Body rather short and deep. Head short, compressed. Eye very large, longer than snout,  $2\frac{3}{4}$  in head. Ventrals extending to beyond last rays of dorsal, reaching anal. Dorsal elevated, its height equal to half its distance from the snout. White; a lateral silvery band, strongly punctate with black; a black band across eye and snout. Head  $4\frac{1}{3}$ ; depth 5. D. 8; A. 9; scales 5–36–2. L.  $2\frac{1}{4}$  inches. Yadkin River, North Carolina. (Cope.)

(Albarnellus altipinnis Cope, Proc. Amer. Phil. Soc. Phila, 1870, 464.)

# 282. M. amabilis (Grd.) Jor.

Body elliptical, rather deep. Head short and rather deep, with large eye, which is considerably longer than shout, 3 in head. Mouth terminal, oblique, the premaxillary opposite middle of pupil, the maxillary barely reaching the front of eye. Shout moderately pointed. Lateral line decurved. Fins moderate. Dorsal somewhat behind ventrals. Color olivaceous; sides silvery; a dusky blotch at base of caudal. Head  $3\frac{1}{5}$ ; depth  $4\frac{1}{3}$ . D. 8; A. 9 or 10; scales 5–38%-3. L.  $2\frac{1}{2}$  inches. Rio Leona, a tributary of Rio Nueces, Texas. (Girard.)

(Alburnus amabilis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 193; Alburnellus amabilis Girard, U. S. Mex. Bound. Surv. 1ehth. 51.)

#### 253. M. megalops (Grd.) Jor.

Very similar, but represented as having the head shorter, deeper, and more obtuse, the premaxillary below the level of the pupil, the maxillary extending to beyond the front of eye. Olivaceous; sides silvery; no black candal spot. Head  $4_4^4$ ; depth  $4_4^4$ . D. 8; A. 9; scales probably as in the preceding. L.  $2_2^4$  inches. Rivers of Texas. (Girard.)

(Alburnus megalops and socius Girard, Proc. Acad. Nat. Sci. Phila. 1556, 193; Alburnellus megalops and socius Girard, U. S. Mex. Bound, Surv. 1ehth. 52.)

# 284. M. Divittatus (Cope) J. & G.

Body stout, the dorsal region arched. Muzzle narrow, not prominent, very obtusely descending. Mouth horizontal, the maxillary reaching the front of the orbit. Eye 4 in head, narrower than the flat interorbital space. Dorsal inserted slightly behind ventrals: pectorals

<sup>\*</sup> Scales small, about 55 in the lateral line.

reaching only half way to ventrals. Color silvery; the scales punctate with blackish; a dark band from the shoulders to the base of caudal; another from the end of the muzzle, across operculum, to base of anal. Head  $4\frac{2}{3}$ ; depth 4. D. 8; A. 7; scales 12-53-11; teeth 2, 4-4, 2. L. 3 inches. Warm Springs, Utah. (Cope.)

(Hybopsis birittatus Cope, Hayden's Geol. Surv. Terr. for 1871, 1872, 474.)

# 285. M. timpanogensis (Cope) J. & G.

Body stout, rather compressed. Head heavy. Month oblique. Eye longer than muzzle,  $3\frac{1}{3}$  in head. Dorsal fin slightly in front of ventrals; pectorals not reaching to ventrals, the latter reaching vent. Lateral line more or less incomplete (in the typical examples, which are all young; it is probably complete in the adult). Color brownish; the scales finely dusted with black points; a plumbeous lateral streak; cheeks silvery; fins dusky. Head  $3\frac{2}{3}$ ; depth 4; scales 13-52-6; teeth 2, 4-4, 2. L. 2 inches. Streams of Utah. (Cope.) This species and the preceding are perhaps young Squalii.

(Hybopsis timpanogensis Cope, Proc. Amer. Phil. Soc. Phila. 1874, 134; Hybopsis timpanogensis Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. 654.)

- e. Seales comparatively small, more or less closely imbricated, and with the exposed edges deep (as in Codoma and Luxilus); scales in front of dorsal small; teeth with the grinding surface more or less developed. (Lythrurus Jordan.\*)
  - d. A black spot at base of dorsal in front.

# 286. M. cyanocephalus (Copeland) Hay.—Hoy's Red-fish.

Body short, stout, chubby, moderately compressed. Dorsal outline elevated, the axis of the body being half nearer the ventral outline than the dorsal. Caudal peduncle short, not contracted, the form resembling that of *Pimephales*. Head very short, deep, its greatest depth three-fourths its length. Snout blunt, shorter than eye. Mouth large, very oblique, lower jaw projecting, maxillary reaching to border of eye. Eye large,  $3\frac{1}{3}$  in head, not so wide as the interorbital space. Fins large. Dorsal well behind ventrals, its longest ray about as long as head; pectorals not reaching ventrals, the latter to anal. Scales small, much crowded anteriorly. Lateral line strongly decurved. Dorsal scales small; thoracic region mostly naked. Coloration dark bluish above; sides not silvery. Males in spring profusely covered with small tubercles; the sides and fins clear, bright red; the back, and especially the top of the head, of a clear glaneous blue. Dorsal fin in both sexes with a large black spot at the base of its anterior rays, this spot about as

<sup>\*</sup>Jordan, Man. Vert. 1876, 272: 1ype Semotilus diplemius Raf. (λύθρον, blood; ουρά, tail.)

large as the eye: dorsal, and, and ventrals blackish at tip. Head  $4\frac{1}{8}$ ; depth 4. D. 8; A. 12; scales 9–46–4; teeth 2, 4–4, 2. L.  $2\frac{1}{3}$  inches. Rivers of Southern Wisconsin, etc.

(Lythrurus cyanocephalus Copeland, Proc. Acad. Nat. Sci. Phila, 1877, 70.)

# 287. M. atripes (Jordan) Hay.

Body moderately clongate, very strongly compressed and elevated. Head comparatively pointed. Mouth rather large, quite oblique, the maxillary reaching to the front of eye; lower jaw projecting. Eye small, shorter than muzzle, 4 in head. Scales closely imbricated, crowded anteriorly. Lateral line strongly decurved. Dorsal fin beginning midway between ventrals and anal, high anteriorly; pectorals not quite reaching ventrals; the latter to vent. Coloration of body dark bluish, without traces of vertical bars; sides not silvery, the scales dusted with dark punctulations; dorsal with the usual black spot at base in front, smaller than in the other species; a black bar crosses its upper part; anal colored like the dorsal, the markings paler; ventral fins dusky. Males profusely tuberculate, and doubtless red in spring. Head 4½; depth 4. D. 7; A. 11; scales 9–52–5; teeth 2, 4–4, 2. L. 3 inches. Southern Illinois. This species, and possibly the preceding also, may be local varieties of *M. diplemius*.

(Luthrurus atripes Jordan, Bull. Ills. Lab. Nat. Hist. ii. 59, 1878.)

# 288. M. dipliermius (Raf.) Hay .- Red-fin.

Body clongate, compressed, little elevated, the caudal peduncle notably long. Head long, conic, rather pointed. Mouth large, moderately oblique, the premaxillary on the level of the pupil, the maxillary extending to opposite the eye, lower jaw somewhat projecting. Eye modcrate, about equal to muzzle, 31 in head. Scales closely imbricated, crowded anteriorly, the antedorsal scales about 30. Dorsal fin high, inserted about midway between ventrals and anal; pectorals not reaching ventrals, the latter to vent; candal fin long. Coloration dark steelblue above; pale or silvery below; the males often showing traces of 8-10 obscure cross-bars; a conspicuous spot at base of dorsal in front; the fins otherwise all plain. Males with the anterior dorsal region and the head profusely covered with small whitish tubercles, the belly and lower tins being of a bright brick-red in the spring. Females very pale olive, sometimes almost colorless. Head 41; depth 41. D. 7; A. 11; scales 9-47-3; teeth 2, 4-4, 2. L. 3; inches. Ohio and Upper Mississippi Valley and lake region; generally abundant in small, clear streams.

(Semotitus diplemius Raf. Ichth. Oh.: Hypsilepis diplumia Cope, Proc. Acad. Nat. Sci. Phila. 1867, 162: Jordan. Man. Vert. 295. Leuciscus diplumius of Kirtland and of Giuther is Laxilus cornatus.,

### 289. M. ardens (Cope) Hay. - Southern Red-fin.

Body elongate, little compressed and not at all elevated. Head long, conic, and pointed. Mouth large, oblique, the lower jaw scarcely longer, the maxillary reaching to opposite the eye. Eye rather large,  $3\frac{1}{2}$  in head. Scales moderate, silvery, not closely imbricated. Lateral line decurved. Dorsal fin as in the other species; pectorals falling considerably short of ventrals. Coloration olivaceous; the scales dark-edged above; the sides with a brilliant silvery band; dorsal with a rather small black spot at base in front. Males in spring tuberculate, the entire body and fins brilliant red; crimson in spring, becoming more searlet later. Young males variously purplish or pinkish. Head  $4\frac{1}{3}$ ; depth  $4\frac{1}{3}$ . Scales 9–50–3; teeth 2, 4–4, 2. L.  $2\frac{1}{2}$  inches. Cumberland, Upper Tennessee, and Roanoke Rivers. A beautiful inhabitant of the clear mountain streams.

(Hypsilepis ardens Cope, Proc. Acad. Nat. Sci. Phila, 1867, 163; Leuciseus ardens Günther, vii, 257.)

## 290. M. punctulatus Hay.

Body short, deep, compressed. Back elevated in front of dorsal. Head short and deep. Profile straight or slightly concave. Month large, quite oblique, maxillary reaching anterior rim of orbit. Eye moderate,  $3\frac{1}{2}$  in head. Scales small, 25 in front of dorsal. Lateral line much decurved. Dorsal beginning midway between muzzle and base of caudal. Caudal peduncle compressed. Straw-color; silvery on sides and below; scales above dark-edged; a dark dorsal line; a dark band on caudal peduncle; a small black spot at base of dorsal. Head  $4\frac{1}{3}$ ; depth  $4\frac{1}{3}$ . D. 8; A. 10 or 11; scales 11-49-3; teeth 2, 4-4, 2, with grinding surface. L. 2 inches. Tusenmbia River, Mississippi. (Hay.)

(Hay, Proc. U. S. Nat. Mus. 1880, 508.)

tt A black spot on the upper auterior part of the dorsal.

### 291. M. realdrigdinanis Hay.

Body long and slender, much compressed. Mouth large, oblique, the lower jaw somewhat projecting, the maxillary reaching the vertical from the front of the eye. Eye large,  $3\frac{1}{2}$  in head, slightly longer than snout. Scales small, especially along the back, somewhat higher than long, but not so closely imbricated as in M, bellus. Lateral line much decurved. Dorsal far back, midway between pupil and base of caudal and considerably posterior to ventrals; pectorals not reaching ventrals, the latter to vent. Dark; scales above all with black points; a plumbeous lateral band, ending in a vague candal spot; a narrow dorsal band; a black spot on the upper anterior portion of the dorsal and also on the anal,

each surrounded by a diffuse blotch; tip of ventrals and edge of pectorals dark; vertical fins red. Head  $4\frac{1}{2}$ ; depth 4. D. 8; A. 11; seales 8-45-3. L.  $2\frac{1}{7}$  inches. Chickasawha River, Mississippi.

(Hay, Proc. U. S. Nat. Mus. 1880, 509.)

th No distinct black spot on the dorsal.

a. Body short and deep.

### 292. M. bellus Hav.

Body short, deep, considerably compressed. Dorsal region elevated. Head short. Muzzle short, rather pointed, the profile somewhat concave. Mouth large, oblique, the maxillary extending to opposite the front of orbit, the lower jaw projecting. Lateral line much decurved. Scales crowded forwards, 25 in front of dorsal. Dorsal midway between snont and caudal, behind ventrals; pectorals not reaching ventrals, the latter to vent. Caudal pedancle slender. Dusky above, with a narrow dark dorsal line; sides silvery, with plumbeous streak; no spot at base of dorsal; fins mostly black-tipped; belly flame color in life; fins orange at base. Head  $4\frac{1}{4}$ ; depth  $3\frac{3}{4}$ . D. 8; A. 10 or 11; scales 7-41-3; teeth 2, 4-4, 2, "sharp-edged, but with a masticatory surface". In 24 inches. Tombigbee River, Mississippi. (Hay.)

(Hay, Proc. U. S. Nat. Mus. 1880, 510.)

aa. Body slender and clongate.

### 293. M. smatutimes (Cope) Jor.

Body slender. Orbit large,  $3\frac{1}{2}$  in head, scarcely larger than length of muzzle, equal to interorbital width. Olivaceons above; the scales brown-shaded; a plumbeons lateral band; sides and below bright silvery; a dark spot at base of candal. Males with the muzzle and chin red. Head  $4\frac{1}{4}$ ; depth 6. D. 8; A. 11; scales 7-44-3; teeth without grinding surface. L.  $2\frac{1}{2}$  inches. Neuse River. (Cope.)

(Alburuellus matutinus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 465.)

#### 294. M. Birus Jordan.

Body slim, compressed. Head small, short, moderately deep, flattish above. Mouth rather large, very oblique, the lower jaw slightly projecting. Eye very large, longer than shout, 3 in head, the maxillary about reaching its front. Scales small, loosely imbricated, their outlines extremely indistinct. Fins moderate. Coloration very pale translucent green; scales of back finely punctate; sides with a very distinct metallic blue band formed of dark punctulations, this band passing through the eye and shout and forming a most characteristic colormarking; a streak of black dots along the bases of dorsal and anal,

that on the dorsal suggesting the peculiar spot of the other *Lythruri*; tip of snout black; fins pale olivaceous, red in the males. Males in spring with the head and antedorsal region profusely tuberculated. Head  $4\frac{1}{3}$ ; depth  $5\frac{1}{4}$ . D. 8; A. 10; scales 8-45-4; teeth 2, 4-4, 2, with very narrow or obsolete grinding surface. L.  $2\frac{1}{2}$  inches. Tennessee and Alabama Rivers.

(Nototropis linus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 342.)

\*\* Scales comparatively large, not higher than long, and not closely imbricated; scales in front of dorsal large; teeth without grinding surface. (Minnilus.\*) b. Anal tin long, its rays 14.

# 295. M. oligaspis (Cope) Jor.

"Under jaw projecting a little beyond upper, maxillary extending to opposite posterior nostril. Head conic in profile, with muzzle compressed, one-fifth of length to notch of caudal. Eye  $3\frac{1}{5}$  in length of head. Operculum higher than long. Fins short (except anal); ventrals anterior to dorsal. D. I, 8; A. I. 14. Scales rather large, 5–41–2; lateral line with a long, gentle anterior deflection. Above reddish; sides of head and broad lateral band silvery; body medially yellowish." (Cope.) L. 2 inches. Kansas. Perhaps a member of some other genus.

(Alburnus oligaspis Cope, Proc. Acad. Nat. Sci. Phila. 1864, 282; Abramis? oligaspis Günther, vii. 209

- bb. Anal fin moderate, its rays 10 or 11.
  - c. Scales above lateral line in about 9 series.

#### 296. M. mendernatilis (Grd.) Jor.

A short, deep species, like a *Notemigonus*. Maxillary reaching orbit. Lateral line deflexed. Olivaceous; sides silvery. Head 4; depth 4. D. 8; A. 11; scales 9-\(^3\)-4. L. 3 inches. Arkansas River. (*Girard*.)

(Alburnus umbratilis Grd, Proc. Acad. Nat. Sci. Phila, 1856, 193: Alburnellus umbratilis Grd. U. S. Pac. R. R. Surv. x, 250.)

- cc. Scales above lateral line in 5-7 series.
  - d. Ventral fins reaching beyond middle of dorsal.

# 297. M. scepticus Jordan & Gilb. sp. nov.

Body short and deep, compressed and somewhat elevated. Head rather large, deep, bluntish, resembling the head of *Minnilus cornutus*. Mouth moderate, terminal, oblique, lower jaw slightly included, upper lip opposite middle of eye, the maxillary extending to front of orbit. Eye very large, longer than snout, 3 in head; interorbital space broad, flattish. Scales large. Lateral line much decurved. Fins moderate;

<sup>\*</sup> Albuenellus Girard Proc Acad. Nat. Sci. Phila, 1856, 193.

the dorsal well behind ventrals, the tips of the ventrals extending to the last dorsal ray. Candal peduncle moderate. Coloration very pale; sides with a bright silvery band: scales with very little dark edging; a dark line at base of dorsal; males in spring with the snout profusely tuberculate. Head 34; depth 4. D. 8; A. 10; scales 6-38-3; teeth 2, 4-4, 1. L. 3 inches. Saluda River, South Carolina.

(Notropis photogenis ("pale variety") Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 22, 1878.)

# 295. M. photogenis (Cope) Jor.

Body more slender, compressed. Head moderate. Mouth quite oblique, lower jaw scarcely projecting; maxillary about reaching orbit. Back broad. Dorsal fin inserted behind middle of body, a little behind ventrals. Lateral line decurved. Eye large, 3\frac{1}{3} in head. Color olivaceous, with brown vertebral and dorsal lines; sides and below bright silvery; checks silvery. Head 4\frac{1}{4}; depth 5\frac{1}{2}. D. 8; A. 10; scales 6-40-3. L. 3 inches. Alleghany region, Pennsylvania, to North Carolina, on both sides of the mountains; abundant and variable. Var. engraulinus Cope is slenderer, the depth 6 in length, the head 3\frac{3}{3}.

(Squalius photogenis Cope, Proc. Acad. Nat. Sci. Phila. 1864, 280: Photogenis leucops Cope, Proc. Acad. Nat. Sci. Phila. 1867, 164: Leuciscus photogenis Günther, vii, 252.)

# 299. M. telescopus (Cope) Jor. & Gilb.

Very near the preceding, but with the dorsal fin inserted about midway between shout and base of caudal, not much behind ventrals. Eye longer than muzzle, 2\frac{3}{4} in head. Mouth very oblique, mandible not projecting. Color pale greenish; the scales extensively dark-edged above. Head 4\frac{1}{4}; depth 5. D. 8: A. 10; scales 5-38-3. L. 3\frac{1}{2} inches. Tennessee River.

(Photogenis telescopus Cope, Proc. Acad. Nat. Sci. Phila, 1867, 165 : Leuciscus telescopus Günther, vii, 252.)

### 300. M. stilbius Jordan.

Body rather slender. Head rather long, somewhat pointed. Mouth large, oblique, the maxillary reaching to the eye. Eye very large, greater than snont and than interorbital width, 3 in head. Fins rather high; the ventrals reaching to opposite the last rays of the dorsal. Color pale silvery green; sides with a broad silvery band, on which are many dark punctulations; these are numerous just behind the shoulder-girdle and at the base of the candal, where they form an evident spot; checks pure silvery; lips dusky. Head  $4\frac{1}{5}$ ; depth 5. D. 8; A. 10; scales 5-37-2; teeth 2, 4-4. L. L. 3 inches. Alabama River.

(Nototropes stilbius Jordan, Ann. Lyc. Nat. Hest. N. Y. 1976, 349.)

### 301. M. percobromus Cope.

Body moderately elongate. Head rather long, the muzzle acuminate. Mouth oblique, the jaws equal, the maxillary extending behind front of orbit. Eye moderate,  $3\frac{1}{2}$  in length, as long as snout. Dorsal beginning slightly behind ventrals. Seventeen scales in front of dorsal. Color pale, with lateral silvery band; dorsal scales and scales at base of caudal with dark punctulations. Head  $3\frac{3}{4}$ ; depth  $4\frac{3}{4}$ . D. 8; A. 11; scales 7-37-3; teeth 2, 4-4, 2. L. 2 inches. Saint Joseph, Mo. (Copc.)

(Alburnellus percobromus Cope, Hayden's Geol. Snrv. Wyom, 1870, 440.)

## 302. M. PEDCHES (Ag.) Jor. - Rosy Minnow.

Body long and slender, compressed, the back not elevated. Head blunt, conic, proportionately shorter than in the other species. Month moderate, very oblique, upper lip on the level of the upper part of the pupil, maxillary about reaching to the front of the eye. Eye large, rather longer than snout, 3\frac{1}{2} in head. Fins low; the dorsal well behind the ventrals, the tips of the ventrals extending to beyond the middle of the dorsal. Lateral line decurved. Color translucent green above; sides bright silvery; scales above faintly punctate, but not enough to render them dark-edged, nor to form blotches along the sides; a faint dark vertebral line; males in spring with the snout rosy. Head 4\frac{2}{3}; depth 5\frac{1}{2}. D. 8; A. 11; scales 5-38-3; teeth 2, 4-4, 2. L. 5 inches. Great Lake region and Ohio and Mississippi Valleys; abundant in lakes and river channels. Variable. The largest and handsomest species of this genus.

(??Notropis atherinoides Raf. Amer. Month. Mag. & Crit. Rev. IS18, 204 (very doubtful, perhaps a Notemigonus): Alburnus rubellus Agassiz, Lake Superior, 1850, 334: Alburnus nitidus Kirtland, Cleveland Ann. Sci. 1854, 44: Alburnellus jaculus and args Cope, Cypr. Penn. 1866, 387: Leuciscus rubellus and copei Günther, vii, 254, 255.)

#### 303. M. dimemus Raf.—Emerald Minnow.

Very similar to the preceding, but smaller and more compressed, with shorter snout, smaller eye, narrower and more convex interorbital space, which is not wider than eye, and shorter ventrals, which scarcely reach the middle of the dorsal. Colors very pale; lips dusky. Head  $4\frac{3}{3}$ ; depth  $5\frac{1}{2}$  (to  $4\frac{1}{2}$ ). D. 8; A. 10; scales 6–38–3; teeth 2, 4–4, 2. L.  $3\frac{1}{2}$  inches. Ohio Valley. Described from specimens taken at the Falls of the Ohio.

(Minnilus dinemus Raf. Ichth. Oh. 45: Alburnus dilectus Grd. Proc. Acad. Nat. Sci. Phila. 1856, 193: Alburnellus dilectus Grd. U. S. Pac. R. R. Surv. x, 259: Notropis dilectus and dinemus Jordan, Man. Vert. 296, 297.)

### 304. M. Pubrifrons (Cope) Jordan. - Rosy-faced Minnow.

Body moderately clongate, the back scarcely elevated, the caudal peduncle somewhat contracted. Head longer than in the other species,

conic and rather pointed. Mouth rather large, very oblique, upper lip above the line of the middle of the pupil, the maxillary reaching to opposite the eye. Eye moderate, anterior, 4 in head. Olivaceous above; scales with darker edges; sides silvery; a dark vertebral line; males with the snout tuberculate in spring, the forehead, opercular region, and base of dorsal being then flushed with red. Head 4; depth  $4\frac{\pi}{4}$ , D. 8; A. 40; scales 5–39–3. Teeth 2, 4–4, 2, little hooked, one of them sometimes showing a sort of grinding face. In  $2\frac{\pi}{4}$  inches. Ohio Valley. An elegant species. Much smaller than rabellus, with larger head and deeper body.

(Alburaus rubrijrons Cope, Proc. Acad. Nat. Sci. Plula. 1855, 85: Alburnellus rubrijrons Cope, Cypr. Penn. 1856, 388: Leuciscus rubrijrons Günther, vii, 225: Notropis rubrijrons Jordan, 296.)

# 305. M. jemezamus (Cope) Jor.

Body slender, with long candal pedancle. Head large, the muzzle long-acuminate. Month large, oblique, the upper lip below the line of the pupil, the maxillary extending beyond front of orbit. Eye moderate,  $3\frac{3}{3}$  in head. Dersal rather posterior, the tips of the ventrals extending beyond its last ray. Olivaceous; a broad silvery band, with plumbeous superior margin; a dusky vertebral band. Head  $4\frac{1}{5}$ ; depth 6. D. 8; A. 10; scales 5-34-2; teeth 2, 4-4, 1. L. 3 inches. San Ildefonso (Rio Grande), New Mexico. (Copc.)

(Alburnellus jemezanus Cope, Zoöl, Wheeler's Expl. W. 100th Mer. v, 650, 1876.)

ecc. Ventral ins short, searcely reaching beyond front of dorsal.

### 306. M. micropteryx (Cope) Jor.

Body slender, compressed. Head moderate, rather pointed. Month large, oblique, the upper lip on the level of the pupil, the maxillary reaching to opposite the front of the orbit. Eye small, about as long as muzzle, 3½ in head. Scales large. Lateral line decurved. Fins all quite small, the dorsal farther back than in any of the preceding species, so that the short ventrals do not reach much beyond its anterior rays. Color olivaceous; sides bright silvery; dorsal scales conspicuously dark-edged; a dusky blotch at base of caudal, underlying the silvery lustre. Head 4½; depth 5½. D. 8; A. 10; scales 6-39-2. L. 2¾ inches. Headwaters of Cumberland and Tennessee Rivers.

(Alburnellus micropteryx Cope, Journ, Acad. Nat. Sci. Phila, 1868, 233.)

### 86.-PROTOPORUS Cope.

(Cope, Hayden's Gool. Surv. Terr. 1871, 473: type Protoporus domninus Cope.)

Body rather stout. Mouth normal. No barbel. Teeth 2, 4-4, 1, hooked, without masticatory surface. Scales small, in 50-60 transverse

series. Lateral line short or nearly obsolete. (Dorsal fin not described.) Anal basis short. Small fishes, differing from *Minnilus* in the incomplete condition of the lateral line; possibly merely the young of some Squalius. ( $\pi\rho\tilde{\omega}\tau\sigma\varepsilon$ , before:  $\pi\delta\rho\sigma\varepsilon$ , pore.)

# 307. P. domminus Cope.

Body rather stout, front convex. Muzzle obtuse. Mouth horizontal, end of maxillary not quite reaching orbit. Eye 4 in head. Lateral line not developed as far as the ventral fins. Grayish; a broad dark lateral band, spotted with darker; back and top of head dark. Head  $4\frac{1}{3}$ ; depth 5. D. 8; A. 7; scales 9-56-6; teeth 2, 4-4, 1. L. 2 inches. Fort Hall, Idaho. (Cope.)

(Cope, Hayden's Geol. Surv. Mont. 1871, 473, 1872.

#### 87.-ERICVIERA Cope.

(Cope, Proc. Acad. Nat. Sci. Phila, 1805, 88: type Ericymba buccata Cope.)

Body rather clongate, little compressed. Muzzle broad. Interopercle, suborbital, and dentary bones crossed by conspicuous, externally visible, mucous channels. Lips thin. No barbel. Teeth 1, 4–4, 0, without grinding surface, hooked, the edges entire. Scales rather large. Lateral line continuous. Dorsal fin above ventrals. Anal basis short. Silvery fishes of rather small size, known at once from all other minnows by the cavernous bones of the lower part of head. ( $\frac{1}{2}\rho i$ , an intensive particle;  $zvb\beta\eta$ , a cavity; in allusion to the development of the mucous channels.)

# 308. E. buccata Cope.

Body fusiform, rather elongate, little compressed, the back not elevated. Head rather long, somewhat depressed above, with broad and prominent muzzle. Mouth rather small, horizontal, subinferior, the lower jaw considerably shorter than upper, upper lip below level of pupil, maxillary not reaching to eye, dentary bones dilated, the mucous channels conspicuous. Suborbital very broad, silvery, with an elevated longitudinal ridge and conspicuous cross-lines; operele small. Eye large, 4 in head. Fins small, dorsal over ventrals. Scales moderate. Lateral line nearly straight. Breast scaleless; 15 large scales before dorsal. Color olivaceous, rather pale; sides bright silvery, with bluish reflections; a dark dorsal streak, conspicuous posteriorly; fins plain; males without tubercles or bright colors. Head  $3\frac{5}{6}$ ; depth 5. D. 8; A. 8; scales 5–33–3; teeth 1, 4–4, 0. L. 5 inches. Ohio Valley to Mississippi (Hay); locally very abundant. One of our most remarkable species of Cyprinidæ.

(Cope, Proc. Acad. Nat. Sci. Phila, 1865, 87, and Cypr. Penn. 351; Günther, vii, 185.).

### 88.-PHENACOBIUS Cope.

Sarcidium (lone.)

(Cope, Proc. Acad. Nat. Sci. Phila, 1857, 96; type Phenacobius teretulus Cope.)

Body elongate, little compressed. Mouth inferior, the lower lip thin mesially, but enlarged into a fleshy lobe on each side toward the angle of the mouth, thus presenting a superficial resemblance to that of Exoglossum, with which the genius has probably real affinities; upper lip with a callous covering within; dentary bones distinct, except at symphysis. No barbel. Upper jaw protractile. Teeth 4-4, hooked, without grinding surface. Scales rather small. Lateral line complete. Dorsal fin in front of ventrals; anal basis short. Isthmus extremely wide. Intestines short; peritoneum white. Small species, with the aspect of young suckers. ( $\varphi \sharp \nu a \sharp$ , deceptive;  $\sharp \iota o \sharp$ , life; the appearance of the fish suggesting an herbivorous species with long intestines, which it really is not.)

\* Scales moderate, 43-50 in the course of the lateral line.

# 309. P. teretulus Cope.

Body slender, little compressed, the back not elevated, the candal peduncle stout. Head stout, the muzzle elongate, obtusely decurved, heavy. Month small, inferior, horizontal, the maxillary not reaching to eye. Isthmus wide. Breast scaly. Lateral line nearly straight. Eye large, high up, 3½ in head. Pale yellowish; the scales above darkedged; snout blackish; a plumbeous lateral band; fins plain. Head 43; depth 43. D. 8; A. 7; scales 6-43-5; teeth 4-4. L. 3½ inches. Kanawha Riyer.

(Cope, Proc. Acad. Nat. Sci. Phila, 1867, 96.)

### 310. P. mirabilis (Grd.) Jordan.

Body moderately slender. Head short, rather blunt anteriorly. Mouth small, the maxillary not reaching to the eye. Eye large, 4 in head. Olivaceous; a silvery lateral band and a dusky spot at base of caudal. Head 4: depth 14. D. 8; A. 7; scales 6-51-5 (teeth 1, 4-4, 1?). L. 3½ inches. Arkansas River. (Girard.)

(Exoglossum mirabile Grd. Proc. Acad. Nat. Sci. Phila. 1856, 191, and U. S. Pac. R. R. Surv. x, 256: Exoglossum mirabile Günther, vii, 188: ? Sarcidium scopiferum\* Cope,

<sup>\*</sup>Body moderately elongate, the back not elevated. Caudal peduncle stout. Head rather short and thick, with prominent but obtuse muzzle. Month small, horizontal, wholly inferior, the maxillary not reaching the eye. Top of head flat. Lateral line nearly scraight. Eye large,  $4\frac{1}{5}$  in head. Yollowish, with a silvery lateral band, which terminates in a black caudal spot; no do sal band; fins plain. Head  $4\frac{1}{5}$ ; depth  $4\frac{3}{5}$ . D. 8; A. 7; scales 6-44-5; teeth 4-4. L. 3 inches. (Copc.) Missouri River.

Hayden's Geol. Surv. Wyom. 1870, 440, 1872; Jordan, Bull. Hayden's Geol. Surv. Terr. iv, No. 3, 663 (a rather chubby specimen from the Rio Grande, with scales 6-45-7, the breast naked, is referred by us to this species): ? Phenacobius teretulus var. liosternus Nelson, Bull. His. Mus. Nat. Hist. i, 1876, 43.)

#### 288. P. enfostomus Jordan.

Body rather slender, nearly terete, scarcely compressed at all, back not elevated, caudal peduncle stout. Head very large, the muzzle blunt and heavy, the cheeks tunid. Mouth small, inferior, altogether below the level of the eye, the maxillary barely reaching to the nostrils. Eyes large, high up, behind middle of head, and 3½ in its length. Scales small, thin, and loosely imbricated; the back and belly scaled; chest naked. Lateral line nearly straight. Twenty-two scales in front of dorsal. Fins all small. Width of isthmus 2½ in head. Pale olivaceous; white below; a silvery lateral band, underlaid by dusky, which forms a vague blotch at base of candal; back dusted with dark specks; top of head black; a yellowish vertebral line. Head 4½; depth 5¾. D. 8; A. 7; scales 7-60-5; teeth 4-4. L. 4 inches. Alabama River.

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 332.)

# 312. P. mramops Cope.

Body very slender, little compressed, back not elevated, caudal peduncle long and slender. Head long and rather slender, flat above, the muzzle broad, blunt, and projecting. Mouth entirely inferior, larger than in the other species, with conspicuous lips. Eye large, placed very high, behind the middle of the head,  $3\frac{1}{2}$  in head. Scales small, 24 in front of dorsal. Lateral line straight. Chest and middle line of belly naked. Width of isthmus haif length of head. Fins small. Head  $4\frac{3}{4}$ ; depth 6. D. 8; A. 7; scales 7-60-6; teeth 4-4. Tennessee River.

(Cope, Proc. Acad. Nat. Sci. Phila, 1867, 96.)

#### S9.-ILHINECHTHYS Agassiz.

#### Bluck-nosed Dace.

(Argyreus Heckel, preoccupied in Entomology.)

(Agassiz, Lake Superior, 1850, 353: type Cyprinus atronasus Mitchill.)

Body rather elongate, not much compressed. Mouth small, subinferior, normal, the upper jaw kot protractile, the upper lip continuous with the skin of the forchead, a barbel terminal on the maxillary. Teeth mostly 2, 4-4, 2, hooked, without grinding surface. Intestinal

<sup>\*\*</sup> Scales small, about 60 in the lateral line.

### 313. R. cataractæ (Val.) Jot.-Long-nosed Dace.

Body elongate, little compressed, not elevated. Head long, the muzzle flattened, narrowed, and extremely prominent, the mouth being entirely inferior and horizontal. Eye nearly median, its diameter contained twice in the length of the snout, about 5 times in head. Isthmus wide. Barbel evident. Lateral line commencing opposite the upper posterior angle of the opercle, decurved. Pectoral fins enlarged in the males. Color olivaceous, paler below, with numerous dusky punctulations; the back often almost black; some of the scale's usually irregularly darker, producing a mottled appearance; no black lateral bands; young specimens with a dusky lateral shade; a blackish spot on the opercle; males in spring with the lips, cheeks, and lower fins crimson. Head 4; depth 5. D. 8; A. 7; scales 14–65–8; teeth 2, 4–4, 2. L. 5 inches. New England to Virginia and Wisconsin; frequenting clear and boisterous streams and rock-pools.

(Gobio cataractae Cuv. & Val. xvi, 315, 1842; Leuciscus nasutus Ayres, Bost. Journ. Nat. Hist. iv, 209, 1843; Argyreus nasutus Cope, Cypr. Penn. 369; Rhinichthys nasutus Günther, vii, 189; Ceratichthys cataractae Günther, vii, 176; Rhinichthys marmoratus Agassiz, Lake Superior, 354; Rhinichthys marmoratus Günther, vii, 189.)

### 314. R. maxillosus Cope.

Body elongate, not elevated. Head long, the muzzle long and projecting, as in the preceding species, but rather heavier, the mouth broader, the maxillary extending nearly to the eye. Barbel evident. Eye small, high up, median,  $5^+_4$  in head. Fins small, caudal not deeply forked. Lateral line decurved. Silvery; darker above; a dusky lateral shade, at least in the young. Head 4; depth 5. D. 8; A. 7; scales 11–70–8. L. 5 inches. Upper Missouri region southeastward. Very close to the preceding.

(Cope, Proc. Acad. Nat. Sci. Phila, 1864, 278.)

### 315. R. transmontains Cope.

This species, the common *Rhinichthys* of New Mexico, differs from *Rhinichthys maxillosus* in having the dorsal fin equidistant between the base of the caudal and the end of the muzzle, and in having the longitudinal series of scales below the lateral line more numerous (12–13).

and equal to those above it. D. S; A. 7; scales 13-70-13. Tributaries of the Rio Grande in Colorado and New Mexico. (Cope.)

(Rhinichthys maxillosus Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. v, 644, 1877 (not of Cope, 1864); Cope, Amer. Nat. July, 1879, 441.)

### 316. R. obtustis Agassiz.—Brown-nosed Dace.

Very similar to *R. atronasus*, but usually rather stouter, the barbel more distinct, the head a little shorter, and the coloration somewhat different. Back olivaceous, mottled with darker; sides with a rather faint brownish band, margined above and below with paler; belly silvery; a dusky blotch in the middle of the base of the dorsal fin; males with the pectoral fins enlarged, and with the lateral band rosy. Head 4; depth 4½. D. 7; A. 6; scales 4-63-8; teeth 2, 4-4, 2. L. 3 inches. Wisconsin to Georgia; abundant in clear brooks. Probably a variety of the next species.

(Agassiz, Amer. Journ. Sci. Arts, 1854, 357; Günther, vii, 190; Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 331: Rhinichthys lunatus Cope, Proc. Acad. Nat. Sci. Phila. 1864, 278: Rhinichthys meleagris Agassiz, Amer. Journ. Sci. Arts, 1854, 357: Rhinichthys meleagris Nelson, Bull. Ills. Mus. Nat. Hist. i, 46: Rhinichthys meleagris Günther, vii, 190.)

# 317. R. atronasus (Mitch.) Ag.—Black-nosed Dace.

Body moderately elongate, little compressed. Head moderate, rather broad and flattish above. Snout moderate. Mouth small, horizontal, subterminal, the lower jaw included, barbel minute but probably always present, upper lip on the level of the lower part of the pupil, maxillary not reaching nearly to the eye. Eye small, nearly median, 1½ in snout, 4½ in head. Fins rather small; dorsal fin well back. Scales quite small, somewhat imbedded. Lateral line somewhat decurved. Color blackish above; some of the scales irregularly darker; a black band passing from snout through eye and along the sides of the body; a pale streak below this; belly silvery; males in spring with the lateral band and the lower fins, and sometimes the whole body, bright crimson; males in late summer with the lateral band scarlet or orange, the red color growing fainter later in the season. Head 4; depth 4½. D. 7; A. 7; Lat. 1. 64; teeth 2, 4–4, 2. L. 3 inches. New England to Ohio and Virginia; very abundant in clear brooks and mountain streams.

#### 90.-AGOSIA Girard.

(Cyprinus atronasus Mitch. Trans. Lit. & Phil. Soc. i, 460; Günther, vii, 191.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 186: type Agosia chrysogaster Grd.)

Body moderately elongate. Mouth moderate, normal, the premaxillaries protractile, the maxillaries with a terminal barbel. Teeth 4-4,

hooked, with grinding surface. Scales quite small. Lateral line continuous. Dorsal over or slightly behind ventrals. Anal basis short. Size, aspect, and coloration of *Rhinichthys* and *Apocope*. (A coined name, without meaning.)

# 318. A. chrysogaster Girard.

Body rather stout, the back slightly elevated. Head heavy, the snout bluntly conical, covered with tubercles in males in spring. Mouth small, nearly horizontal, the lower jaw included, premaxillary entirely below the level of the eye, the maxillary not reaching its anterior margin, barbel minute. Eye rather large, about 4 in head. Fins well developed. Lateral line somewhat decurved. Color olivaceous above, with black spots; yellow below; a black streak along the sides. Head  $4\frac{1}{3}$ ; depth  $4\frac{2}{5}$ . D. 9; A. 8.; Lat. 1, 90. L.  $3\frac{1}{2}$  inches. Rio Gila, Arizona. (Girard.)

(Girard, Proc. Acad. Nat. Sci. Phila, 1856, 187, and U. S. Mex. Bound. Surv. Ichth. 48.)

### 319. A. metallica Grd.

Stouter, the head shorter, and the snout more convex. Dorsal rather higher and narrower. Scales (in figure) considerably larger. Coloration and proportions essentially as in the preceding. Lat. 1, 75. Rio Gila.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 187, and U. S. Mex. Bound. Surv. Ichth. 49.)

91.—APOCOPE Copc.

(Cope, Hayden's Gool, Surv. Mont. 1871, 472: type Apocope carringtoni Cope.)

Body somewhat elongate. Month normal, rather small, with thickish lips and a terminal maxillary barbel, premaxillaries protractile. Teeth mostly 1, 4-4, 1, hooked, without grinding surface. Scales very small. Lateral line weak, often more or less broken posteriorly. Dorsal fin inserted behind the ventrals. Anal basis short. Isthmus broad. Size small. Colors dusky, with red in spring. The species are closely related and difficult to separate, and the genus is searcely distinct from Agosia. ( $\partial \pi \sigma z \sigma \pi \dot{\eta}$ , a deficiency, in allusion to the incompleteness of the lateral line.)

#### 320. A. carringtoni Cope.

Body rather stout. Head blunt and heavy, the snout searcely overhanging the mouth; maxillary not quite reaching the line of the orbit; barbels minute; isthmus wide. Eye  $4\frac{1}{4}$  in head,  $1\frac{1}{2}$  in interorbital

Bull, Nat. Mus. No. 16----14

<sup>\*</sup> Lateral line with 60-70 scales.

width. Dorsal fin slightly behind ventrals, nearer caudal than muzzle. Lateral line in the young running about half way to caudal, nearly complete, or wanting on some scales only in the adult. Olivaceous; a dark lateral band; dark shades along the back; males with the loral region and the bases of all the fins except the dorsal scarlet. Head  $4\frac{1}{8}$ ; depth 5. D. 8; A. 7; scales 10-60-11; teeth 1, 4-4, 1. L. 4 inches. Utah to California; very abundant in rock-pools.

(Cope, Hayden's Geol. Surv. Mont. 1871, 472: Jordan & Henshaw, Rept. Chief Eng. U. S. Geog. Surv. W. 100th Mer. 1875, 191.)

## 321. A. mubil: (Grd.) Jor. & Gilb.

This species is very similar to A, carringtoni, but in Girard's original types the head is quite slender, while in the latter species it is blunt and stout. Lateral line continuous, but broken and feeble posteriorly. Body stout. Mouth small, barbels small. Fins rather small. Color blackish, with a darker lateral shade. Head black above. Head  $4\frac{1}{5}$ ; depth  $4\frac{1}{5}$ . D. 8; A. 7; Lat. 1. 66. L. 4 inches. Washington Territory.

(Argyreus nubilus Girard, Proc. Acad. Nat. Sci. Phila. 1856, IS6: Argyreus nubilus Girard, U. S. Pac. R. R. Surv. x, 244.)

### 322. A. vuinerata Cope.

Body elongate. Muzzle obtuse, not projecting. Month inferior, horizontal, maxillary not reaching line of orbit. Eye as long as muzzle, 4 in head. Dorsal fin behind line of ventrals, nearer caudal than snout. Barbels small. Olivaceous; yellow below; a blackish lateral band; head blackish above; males with the chin red. Head  $4\frac{1}{3}$ ; depth  $5\frac{1}{5}$ . D. 8; A. 7; scales 12-65-12; teeth 1, 4-4, 1. L.  $2\frac{1}{2}$  inches. Utah to California, Oregon, and Arizona; generally abundant in the mountain region.

(Cope, Hayden's Geol. Surv. Mont. 1871, 473; Cope, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 1876, 646; Jordan & Henshaw, Rept. Chief Eng. U. S. Geog. Surv. W. 100th Mer. 1878, 191: Tigoma rhinichthyoides Cope, Hayden's Geol. Surv. Mont. 1871, 473: Apocope conesi Yarrow, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 1876, 648.)

# 323. A. henshavii Cope.

Body rather elongate. Muzzle rather long, broad, obtuse, but everhanging the mouth. Barbel small. Eyes small, high up, shorter than snout. Ventral fins reaching anal, but not reached by the pectorals; dorsal fins originating somewhat behind base of ventrals. Color pale, with a few dark clouds on the sides and dark shades on head; lower fins red at base; young with dark cross-streaks. Head  $4\frac{1}{4}$ ; depth  $4\frac{1}{2}$ . D. 9; A. 7; scales 14-62-10; teeth 1, 4-4, 1. Utah and Idaho; abundant in Provo River. Not very different from the preceding.

(Rhinichthys hensharii Cope, Proc. Amer. Phil. Soc. Phila. 1874, 133; Cope, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 645.)

# 324. A. oscula (Grd.) Cope.

Differs from A. henshavii in having a longer and more attenuated body, and narrow, sharp-pointed muzzle. Base of dorsal intermediate between base of caudal and end of snout; ventrals reaching anal, but not reached by pectorals. Yellowish white above; bright yellow below; a broad blackish lateral band; a narrow black stripe around muzzle; males with the lower jaw and lower fins crimson in life. Head  $4\frac{3}{4}$  ("in total length"); depth  $7\frac{1}{2}$ ; eye  $4\frac{1}{2}$  in head. D. 8; A. 7; scales 10-63-10. Colorado to Arizona. (Cope.)

(Argyreus osculus and notabilis Grd. Proc. Acad. Nat. Sci. Phila. 1856, 186, and in U. S. Mex. Bound. Surv. Ichth. 47; Cope, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 647.)

# 325. A. ventricos: Cope.

Body rather elongate. Muzzle obtuse, but narrowed anteriorly, not overhanging the mouth. Eye 4 in head, shorter than shout. Candal peduncle stout. Barbels small, sometimes obsolete. Scales very small. Dusky olive above; a blackish lateral band. Males with the axils of the pectorals and ventrals scarlet; a scarlet spot above the gill-openings and one on the side of the muzzle. Head 4; depth  $4\frac{3}{4}$ . D. 8; A. 7; scales 18–89-15; teeth 1, 4-4, 1. L.  $2\frac{3}{4}$  inches. New Mexico to Arizona and Oregon; abundant.

(Ceratichthys rentricosus Cope, Proc. Amer. Phil. Soc. Phila. 1876, 136; Cope, vol. v, Zoöl, U. S. Geog, Surv. W. 100th Mer. 648; Jordan & Henshaw, Rept. Chief Eng. U. S. Geog, Surv. W. 100th Mer. 1878, 192.)

#### 92.—CERATICHTHYS Baird.

Horny Heads.

(Nocomis Grd; ? Hybopsis Ag.)

(Baird, 1853, brief notice; Girard, Proc. Acad. Nat. Sci. Phila. 1856, 212: type Semott-lus biguttatus Kirtland.)

Form various. Mouth terminal or inferior, with lips thin or somewhat fleshy, a conspicuous barbel terminal on the maxillary, premaxillaries projectile. Teeth 4–4, or 1, 4–4, 1 or 0, hooked, without evident grinding surface. Scales rather large. Lateral line continuous. Dorsal fin inserted over, in front of, or slightly behind ventrals; anal basis short. A large and varied group. (zzpaz, horn; zzpaz, fish; from the nuptial tubercles of the typical species.)

The species may be thus divided:

biguttatus, micropogon, symmetricus.

<sup>\*\*</sup> Lateral line with 80-90 scales.

<sup>\*</sup> Species of large size, with the mouth anterior, the lower jaw included; the dorsal fin slightly behind the ventrals (Chranchithus).

- \*\* Species of small size, with the mouth subinferior and horizontal; the dorsal fin inserted slightly in front of the ventrals, and the scales generally large and silvery (? Hybopsis Agassiz).

labrosus, zanemus, monachus.

\*Species of large size, with the month anterior, the lower jaw included; the dorsal fin slightly behind the ventrals. (Ceratichthys.)

### 326. C. Diguttatus (Kirt.) Grd,-Horny Head; River Chub; Jerker.

Body rather robust, little elevated, little compressed. Head large, rather broadly rounded above; the snout conical, bluntish. rather large, subterminal, little oblique, the lower jaw somewhat the shorter, the upper lip rather below the level of the eye, and the maxillary not reaching to the front of the eye. Eye small, median, high up. Suborbitals very narrow; preorbital large. Fins moderate; the dorsal rather posterior, slightly behind the insertion of the ventrals: caudal broad, little forked. Scales large, not crowded anteriorly, 18 rows in front of the dorsal. Lateral line somewhat decurved. Color bluish olive; sides with bright green and coppery reflections; a curved dusky bar behind the opercle; scales above with dark borders; belly pale, but not silvery, rosy in spring males; fins all pale orange, without black spot. Males in spring with a crimson spot on each side of the head; the adults with the top of the head swollen, forming a sort of crest, which is sometimes a third of an inch higher than the level of the neek and is covered with large tubercles; young with a dark caudal spot. Barbel well developed. Head 4; depth 4!. D. 8; A. 7; scales 6-41-4; teeth 1, 4-4, 1, or 1, 4-4, 0, sometimes 4-4. L. 6-9 inches. Pennsylvania to the Great Basin of Utah and southward; everywhere abundant. The most widely diffused of our Cyprinida. Western specimens usually have the teeth in two rows.

(Semotilus biguttatus Kirtland, Bost, Journ. Nat. Hist. 1540, iii, 341; Cope, Cypr. Penn. 1866, 366; Günther, vii, 175; Nocomis nebrascensis and ? Nocomis bellicus Girard, Proc. Acad. Nat. Sci. Phila. 1859, 243; Ceratichthys cyclotis and stigmaticus Cope, Proc. Acad. Nat. Sci. Phila. 1864, 277, 275; Ceratichthys cyclotis Günther, vii, 178; Ceratichthys stigmaticus Günther, vii, 179.)

### 327. C. micropogon Cope.

Body moderately stout. Head much as in *Minnilus cornutus*, broad, the muzzle obtuse, the profile rounded, descending. Month slightly oblique, its angle opposite front of the orbit. Eye  $3\frac{1}{4}$  in head. Barbel minute. Caudal peduncle slender. Yellowish brown, with brown ver-

tebral band: a brown lateral shade. Head  $3\frac{3}{4}$ ; depth  $4\frac{1}{4}$ . D. 8; A. 7; scales 6-40-3; teeth 4-4. L.  $3\frac{1}{2}$  inches. One specimen known, from Conestoga River, Pennsylvania. Perhaps a variation of the preceding. (*Cope.*)

(Cope, Proc. Acad. Nat. Sci. Phila, 1864, 277; Günther, vii, 179.)

### 328. C. symmetriens (Baird & Girard) J. & G.

Body clongate, slender, moderately compressed, not clevated. Head short, rather slender and pointed. Mouth small, little oblique, the lower jaw included. Eye large, anterior, longer than snout, 3 in head. Barbel small, but evident. Scales small, rather loosely imbricated. Lateral line strongly decurved. Dorsal slightly behind ventrals. Coloration pale: scales dotted with black; checks silvery. Head  $4\frac{\pi}{3}$ ; depth 6. D. 8; A. 8; scales 9–58–4; teeth 4–4, without grinding surface. L. 6 inches. Rivers of California.

Progonichthys symmetrieus B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 156: Leucosomus symmetricus Günther, vii, 267.)

b. Teeth (wo-rowed.

#### 329. C. cumingi Günther.

#### 330. C. Incens Jordan.

(Günther, vii. 177.)

Body clongate, compressed, the back somewhat elevated from the occiput to the base of dorsal, thence rapidly declined to the long and slender caudal pedancle. Head short, compressed, the cheeks nearly vertical. Interorbital space rather broad and flat, somewhat grooved. Eye very large, circular, high up, placed nearly midway of the length of the head, its diameter about equal to the length of the snout and

<sup>\*\*</sup> Species of small size, with the mouth subinferior and horizontal; the dorsal fin inserted slightly in front of the ventrals, and the scales generally large and silvery. (Hybopsis Agassiz.\*)

<sup>\*</sup>Agassiz, Amer. Journ. Sei. Arts. 1854, 358 . type Hybopsic gracibs Ag. († 30), gibbous : bab . face.

searcely greater than the width of the interorbital space. Preorbital bone large, oblong, conspicuous, and silvery. Mouth rather small, horizontal, the lower jaw included, the edge of the premaxillary below the level of the eye, the maxillary not reaching to the vertical from the front of the orbit. Barbel quite small. Snout boldly and abruptly decurved much as in C. amblops, the tip of the snout thickened, forming a sort of pad. Lateral line decurved. Rows of scales along the back converging behind the dorsal where the upper series run out, as in Minnilus cornutus. Fins rather higher and more falcate than in C. biguttatus. The dorsal fin inserted well forward, over ventrals. Pectoral fins pointed, not reaching ventrals, ventrals not reaching vent, Teeth 4-4, hooked, without grinding surface. Translucent greenish above; sides and below brilliantly silvery; cheeks and opercles with a bright silvery lustre; fins plam; a slight plumbeons lateral shade. Head 4\frac{1}{2}; depth 4. D. 8; A. 8; scales 5-42-4. L. 5 inches. Falls of the Ohio. (Jordan, Proc. U. S. Nat. Mus. 1579, 238.)

### 331. C. amblops (Raf.) Grd.—Silver Chub.

Body rather slender, somewhat heavy anteriorly, not much compressed. Head large, somewhat flattened and broad above. Eye very large, longer than snout and longer than interorbital space, 3 in head. Mouth horizontal, subinferior, and rather small. Muzzle bluntly decurved. Upper lip below level of orbit, maxillary not reaching the line of the front of the orbit. Barbel evident. Fins moderate. Lateral line somewhat decurved. Sixteen scales before dorsal. Color translucent greenish above; scales somewhat dark-edged; sides with a bright silvery band, which overlies dark pigment, so that sometimes a plumbeous or even blackish band appears; a dark band through eye around snout; males without tubercles or red coloration. Head 4; depth 5. D. 8; A. 7; scales 5–38–4; teeth 1, 4–4, 1. L. 2–4 inches. Ohio Valley and southward. Southern specimens (var. winchelli) have the head narrower and the barbel rather shorter.

(Rutilus ambleps Raf. 1chth. Oh. 1820, '4: ? Hybopsis gravilis Agassiz, Amer. Journ. Sci. Arts. 1854, 358; Gobio vernalia and Hybopsis winchelli Grd. Proc. Acad. Nat. Sci. Phila. 1856, 188, 241; Cerwichthys hyalinus Cope, Journ. Acad. Nat. Sci. 1869, 236; Ceratichthys hyalinus Günther, vii, 179; Nocomis amblops Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 328.)

#### 332. C. Pubrickons Jordan.

General form of the preceding. Head long, narrower than in the preceding, longer than in the next. Eye moderate,  $3\frac{1}{3}-3\frac{1}{2}$  in head, wider than the interorbital space. Month smaller, inferior, overhung by the bluntly

decurved but not very broad muzzle. Barbels quite long and distinct. Thirteen scales in front of the dorsal. Fins well developed; the first developed rays of the dorsal about twice the height of the last. Pale olivaceous; sides with a plumbeous silvery band, in some specimens forming a stripe through eye and snout, and a dark spot at base of caudal; cheeks silvery; snout in males red, with numerous dust-like tubercles; specimens in high spring coloration have the fins largely red. Head 4; depth 5. D. 8; A. 7; scales 5-36-3; teeth 1, 4-4, 0. L. 3 inches. Basin of the Altamaha, Georgia.

(Nocowis rubrifrons Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 330.)

## 333. C. hypsinotus Cope.

Body much stouter, more elevated, and more compressed than in the preceding. Head short, broad above, much smaller and more conical than in the preceding. Outline of back rather abruptly declining behind front of dorsal fin, so that the base of the fin is oblique. Month inferior, horizontal, small, the maxillary reaching the line of the orbit. Barbels small. Eye small,  $3\frac{1}{2}$  in head. Color silvery, with a double series of black specks along the lateral line, and a lateral band of dusted blackish, which passes through eye and shout; males with the fins bright red, and the body with a deep violet lustre, as in *Minnilus rubrieroccus*. Head  $3\frac{3}{4}$ ; depth 4. D. 8; A. 8; scales 5-40-3; teeth 1, 4-4, 1. L. 3 mehes. Santee Basin, in North Carolina and South Carolina.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 458; Jordan & Brayton, Bull. U. S. Nat. Mas. xii, 1878, 25. Ceratichthys leptocephalus Grd. Proc. Acad. Nat. Sci. Phila. 1856, 213, from Salem, N. C., may be the same, but the description is wholly insufficient for determination.)

bb. Teeth one-rowed.

### 334. C. dissimilis (Kirtland) Cope.—Spotted Shiner,

Body long and slender, little compressed, with long caudal pedantele. Head long, rather flat above, the snout somewhat bluntly decurved, projecting a little beyond the rather small, horizontal mouth; lower jaw included; both jaws with the skin hard in front, forming a sort of lip laterally. Barbel considerably shorter than pupil, maxillary not reaching nearly to orbit. Eye very large, high up, somewhat directed upward, rather behind the middle of the head, forming more than one-third the length of the head. Opercle small. Dorsal rather large, its posterior border oblique; anal small; caudal well forked; pectoral rather long. Scales rather large, 22 in front of dorsal. Lateral line nearly straight. Olivaceous; sides silvery, with a bluish lateral band, which is widened into several dusky spots, formed by dark punctulations,

and most distinct posteriorly; a dusky band on head, through eyes and snout: fins plain. Head  $4\frac{1}{7}$ : depth  $5\frac{1}{7}$ . D. 8; A. 7; scales 6-47-5; teeth 4-4, often with slight grinding surface. L. 5 inches. Ohio Vallev and tributaries of the Great Lakes.

(Leuciscus dissimilis Kirtland, Bost, Journ, Nat. Hist, iii, 341, 1840; Ceratichthus dissimilis Cope, Cypr. Penn. 367: Ceratichthys dissimilis Günther, vii, 177.)

#### 335. C. sterletus Cope.

Body slender, with long caudal peduncle, the least depth of which is little more than a third of the greatest depth of the body. Head long and slender, the muzzle much projecting and broadly rounded. Month moderate, inferior, the maxillary not reaching the front of orbit. Barbels conspicuous. Eve moderate, 43 in head. Fins rather long, the candal deeply forked. Color silvery: sides with a few dusky scales: forehead pink in the males, as in C. rubrifrons. Head 4: depth 43. D. 8: A. 7: scales 6-36-5; teeth 4-4. Rio Grande, in New Mexico. (Cone.) (Cope, Zoöl, Wheeler's Expl. W. 100th Mer. v. 652, 1876.)

### 336. C. restivalis (Grd.) Cope.

Head contained about  $4\frac{1}{2}$  times in the total length. Differs from  $G_{\bullet}$ gelidus and G. rernalis, its American congeners, by a rather compressed body, elevated and arched upon its middle region, and tapering rapidly towards the pedancle of the tail. The snout is more protruding than in G. gelidus, the eye larger, and the ventral fins inserted somewhat more forwards. The scales are also larger (about 36 in the lateral line in the figure), deeper than long, anteriorly subtruncated and posteriorly rounded, with radiating furrows upon the latter section only. D. I, 8; A. I. 7, etc. The color is yellowish brown, somewhat lighter beneath than above, with a silvery streak along the middle of the flanks. Rio San Juan, Cadarcita, New Leon. (Girard.) (Of course these little fishes have no intimate relation with the European genns Gobio, which is an ally of Semotilus, with the teeth 3, 5-5, 3, and the barbel lateral and very long.)

(Gobio asticulis Girard, Proc. Acad. Nat. Sci. Phila, 1856, 189.)

### 337. C. gelidus (Grd.) Jor.

Body very slender, not elevated. Head slender and elongate, the snont prominent and tapering. Eye small, rather high, 4 in head. Mouth small, subterminal, the maxillary not extending to the eye. Fins large. Lateral line decurved. Scales rather large. Coloration silvery; a dusty lateral streak, and a blackish spot at base of caudal. Head  $3\frac{3}{4}$ ; depth  $5\frac{1}{2}$ . D. 8; A. 8; Lat. l. 44. L. 2 inches. Milk River, Montana. (Girard.)

(Gobio gelidus Grd. Proc. Acad. Nat. Sci. Phila, 1856, 188, and U. S. Pac. R. R. Surv. 248.)

\*\*\*Species of small size, with the mouth subinterior and horizontal, with thickened lips: the dorsal fin inserted slightly behind the ventrals, usually with a black blotch on its last rays; scales rather large, silvery,

#### 338. C. labrosus Cope.

Body slender, little compressed, the back not elevated. Head long, gently decurved to the muzzle, which scarcely overbangs the mouth. Mouth entirely horizontal, the maxillary reaching the orbit. Eye 3\frac{3}{4} in head. Dorsal inserted slightly behind origin of ventrals (not directly over, as stated in original description). Lips thickened. Barbels very long. Color silvery: sides sometimes with vague, dusty cross-bars. Head 4\frac{1}{4}: depth 5\frac{1}{2}. D. 8: A. 8: scales 6-34-4: teeth 1, 4-4, 1. L. 2\frac{1}{2} inches. Catawba River, North Carolina. (Cope.)

(Cope, Proc. Amer. Phil. Soc. Phila, 1870, 458.)

## 339. C. zanemus Jordan & Brayton.

Body long and slender, little compressed. Head rather long, narrow, and pointed, very slender in young specimens, stonter in adults. Snout decurved in profile, an angle in front of the nostrils. Muzzle long, overhanging the large mouth. Lips much thickened, the lower with a conspicnous internal fringe of papillae. Barbels extremely long, longer than in any other of our Cyprinida, their length more than half the diameter of the eye. Eye moderate, nearly median, 33 in head. Scales moderate, closely imbricated, 16 in front of dorsal. Lateral line slightly decurved anteriorly. Fins rather small. Candal deeply forked, its peduncle long and slender. Coloration pale: a small, round black spot at base of candal: dorsal scales dark-edged: a dark lateral streak, obsolete anteriorly: large specimens with a large dark patch on the last rays of the dorsal, as in Cliola analostana; base of the candal with dark points; males in spring with the head and neck profusely tuberculate and the fins flushed with crimson. Head  $4\frac{1}{4}$ ; depth  $4\frac{1}{4}$ . D. 8; A. 7; scales 5-40-3; teeth 1, 4-4, 1. L. 3 inches. Salnda River, South Carolina. (Jordan & Brayton, Bull, U. S. Nat. Mus. xii, 25, 1878.)

### 340. C. monachus Cope.

Body slender, somewhat compressed, not much elevated. Head long and rather slender, flattish above, with projecting muzzle. Month inferior, horizontal, small, the maxillary not reaching the eye, which is rather small,  $4\frac{1}{5}$  in head. Scales rather small. Lateral line somewhat decurved. Twenty-four scales in front of dorsal. Fins moderate. Color light olive; a metallic vertebral band; sides and belly silvery; no lateral band; a black spot at base of caudal; muzzle dusky; membrane of upper posterior part of dorsal fin black. Head 4; depth  $5\frac{1}{4}$ . D. 8; A. 8; scales 8-56-4; teeth 4-4. L. 4 inches. Tennessee River.

(Cope, Journ. Acad. Nat. Sci. Phila, 1867, 227.)

#### 93 .- COUESIUS Jordan.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 785, 1878: type Nocomis milneri Jordan = Leucosomus dissimilis Grd.)

Body elongate. Head normal, not depressed, the profile convex. Mouth terminal, normal, a well-developed barbel at the posterior end of the maxillary. Teeth 2, 4-4, 2, hooked, without grinding surface. Scales rather small. Lateral line continuous. Dorsal fin over or slightly behind ventrals; anal basis short. Size rather large. (Dedicated to Elliott Coues.)

\*Scales small, 60-70 in the course of the lateral line.
†About thirty scales in a transverse series from dorsal to ventrals.

# 341. C. squamitentus (Cope) Jor.

Form stout, profile nearly plain. Muzzle not prominent. Month horizontal, the maxillary not reaching the orbit. Eye rather small, 43 in head, shorter than snout. Isthmus wide. Barbel quite small. Dorsal fin slightly in advance of ventrals, behind middle of the body. Scales quite small. Olivaceous above; sides silvery; a lateral band of dark punctulations. Fins plain. Head 34; depth 5. D. 8; A. 7; scales 17-66-14; teeth 2, 4-4, 1. Henry's Fork of Green River, Wyoming. (Cope.)

(Ceratichthys squamilentus Cope, Hayden's Gool, Surv. Wyom, 1870, 442, 1872.)

it About 20 scales in a transverse series from dorsal to ventrals.

# 342. C. dissimilis (Grd.) Jor.

Form of Semotilus corporalis, but more elongate and less compressed. Head flattish above, the snont broad, projecting over the large, oblique mouth, maxillary reaching front of eye. Barbel very evident. Eye large, as long as snont, about 4 in head, 1½ in interorbital space. Scales small, crowded forwards, those on the back smaller. Dorsal fin beginning over last ray of ventrals. Dusky above; sides somewhat silvery; an obscure dusky band through eye around snont; fins plain. Head 4½;

depth 4½. D. 8; A. 8; scales 11-68-7; teeth 2, 4-4, 2. L. 6 inches. Lake Superior to Upper Missouri region; probably abundant.

(? Gobio plumbeus Agassiz, Lake Superior, 366; Leucosomus dissimilis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 189, and U. S. Pac. R. R. Surv. x, 250; Nocomis milneri Jordan, Bull. U. S. Nat. Mus. x, 64, 1876; Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 784, 1878.)

### 313. C. prosthemius (Cope) Jor.

Body fusiform, rather slender. Head small, the muzzle abruptly descending. Mouth rather small, somewhat oblique, the maxillary not reaching to the orbit. Eye 4 in head. First ray of dorsal opposite ventrals. Color dusky; a plumbeous lateral band; white below; fins plain. Head 5; depth 5. D. 8; A. 7; scales 41-63-8, somewhat crowded anteriorly; teeth 2, 4-4, 2. L. 6 inches. Upper Great Lakes.

(Ceratichthys prosthemius Cope, Cypr. Penn. 1866, 365; Ceratichthys plumbeus Günther, vii, 442.)

\*\* Seales rather large, about 50 in the lateral line and 10 in a transverse series.

# 341. C. physignathus (Cope) Jor.

Body slender, the caudal peduncle stout. Head wide and depressed. Dorsal outfine little arched, the profile descending steeply to the lip. Lower jaw included, maxillary reaching anterior border of orbit. Barbels well developed. Eye  $\frac{12}{8}$  in head,  $\frac{11}{2}$  in muzzle. Twenty-three rows of scales in front of dorsal. Dorsal fin inserted in front of ventrals. Olivaceous above, white below; a plumbeous lateral band; fins plain. Head  $\frac{32}{3}$ ; depth 5. D.8; A.8; scales 5–49–4; teeth 2, 4–4, 2. Arkansas River at Pueblo. (Cope.)

(Ceratichthus physiquathus Cope, Wheeler's Expl. W. 100th Mer. v, 651, 1876.)

### 91.-PLATYGORIO Gill.

#### Flat-headed Chubs.

(Gill, Proc. Bost, Soc. Nat. Hist, 1861: type Pogonichthys communis Grd.)

### 315. P. gracilis (Rich.) Gill & Aor. - Flat-headed Chub.

Body rather elongate, somewhat compressed, little elevated. Head small and short, its upper surface very broad and depressed, the interorbital width being nearly half the length of the head. Mouth rather large, slightly oblique, the upper lip on the level of the lower part of the eye, the maxillary reaching the line of the front of the eye, the upper jaw very protractile, the lower jaw included. Eye small, rather high up and anterior, 6 in head. Fins rather large; dorsal in advance of the middle of the body; caudal peduncle rather stont. Scales large and silvery; lateral line decurved; 23 scales in front of dorsal. Coloration pale; back bluish; sides and below silvery; head mostly white; fins pale. Head 4½ depth 4½. D. 8; A. 8; scales 6-50-5; teeth 2, 4-4, 2. L. 12 inches. Rocky Mountain region from the Kansas and Yellowstone Rivers to the Saskatchawan; abundant.

(Cyprinas (Lenciscus) gravilis Rich, Fauna Bor.-Amer. Pisc. 1836, 120: Pogonichthys communis Grd. Proc. Acad. Nat. Sci. Phila. 1856, 188, and U. S. Pac. R. R. Surv. x, 247: Pogonichthys communis Gill. Ichth. Captain Simpson's Surv. 408: Pogonichthys (Platygobis) gulonellus Cope, Proc. Acad. Nat. Sci. Phila. 1861, 277: Leuciscus gravilis Günther, vii. 240: Leucosomus communis and gulonellus Günther, vii. 267, 268.)

### 346. P. Dallidus Forbes, sp. nov.

"The depth is contained 42 times in length, and the head 4. The eye equals the snout, and enters length of head 33 times and the interorbital space twice. The head is flat above and the snout overlangs the mouth, which is large and wide, with a maxillary barbel about one-third as long as the eye. The mandible reaches a vertical line drawn through the middle of the iris in front. The greatest depth of the head enters its length 13 times. The scales are 6-55-5, with 22 rows before dorsal, where they are much smaller than elsewhere. The lateral line is straight, except for a few scales in front. The pectoral fins are large and pointed, reaching the ventrals, and the latter attain the vent. The front of the dorsal is situated a trifle before the ventrals and a little nearer snout than candal. D. 8; A. 8. The color in alcohol is plain, with a plumbeous lustre along sides, and traces of a dusky lateral stripe behind dorsal. The pharyngeal teeth are stout, 2, 4-4, 2, hooked, with masticatory surface. L. 23 inches. One specimen from the Ohio River at Cairo, probably adult, as the snont is tuberculate." (Forbes, MSS.)

#### 95.-SEMOTILUS Rafinesque.

Chubs.

(Leucosomus Heekel: Chilonemus Baird.)

(Rafinesque, Ichth, Oh. 49, 1-20): type Semotilus dorsalis Raf. = Cyprinus corporalis Mitch.)

Body robust. Head large. Mouth terminal, the upper jaw protractile, a small barbel on the maxillary just above its extremity. In.

testinal canal—short. Teeth 2, 5–4, 2, hooked, without masticatory surface. Scales moderate. Lateral line continuous. Dorsal more or less posterior to ventrals. Anal basis short. Species of large size, differing from Squalius in the presence of a maxillary barbel. ( $\sigma_{\eta}^{2}/a$ , banner—i, e, dorsal fin: the second–part of the word was elsewhere used by Rafinesone to mean "snotted".

\*Insertion of dorsal (in evidently behind ventrals and notably behind the middle of the body; scales reduced in size and much crowded anteriorly; a black spot at base of dorsal in front. (Semotibus,)

### 347. S. corporalis (Mitch.) Putn.—Chub; Horned Dace.

Body stout, the dorsal outline arched in front of the dorsal, the body tapering backward from a point considerably in advance of the dorsal. so that the base of that fin is oblique. Head large and heavy, broad and rounded above. Snout broad. Mouth broad, oblique, the lower jaw slightly included, the upper lip just below the level of the pupil. the maxillary barely reaching the front of the pubil: maxillary barbel small, not evident in specimens of less than 2 or 3 inches in length. Eye rather small, about 5 in head. Scales small, considerably crowded and reduced anteriorly, about 30 series in front of the dorsal fin. Lateral line considerably decurved. Fins small; the dorsal well behind ventrals, its last ray well in advance of the base of anal. Color dusky bluish above; sides with a vague dusky band, black in the young. disappearing in the adult; belly creamy, rosy-tinted in the males in spring; dorsal fin always with a conspicuous black spot at the base in front, which is bordered with red in the male; a dark vertebral line; scales everywhere edged with dark punctulations; a dusky bar behind opercle; males with the suont coarsely tuberculate in spring. Head 33; depth 4. D. 7; A. 8; scales 9-58-6 [those in the lateral line varying from 52 (? var. pallidus, Alabama to Arkansas) to upwards of 65]; teeth 2, 5-1, 2. L. 10 inches. Western Massachusetts to Georgia and Upper Missouri; everywhere very abundant, ascending small streams.

(Cyprinus corporalis and atromaculatus Mitchill, Amer. Month. Mag. ii, 321: Semotilus dorsalis and cephalus Rafinesque, Ichth. Oh. 49: Leuciscus iris and storeri Cuv. & Val. xvii: Semotilus corporalis Cope, Cypr. Penu. 363: Leucosomus corporalis Giinther, vii, 269: Leucosomus pallidus (Lat. 1. 52), Leucosomus incrassatus (Lat. 1. 64), Semotilus macrocephalus, and Semotilus speciosus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 251, 252, 204.)

### 318. S. thoreamianus Jordan.

Body short and rather stout, abruptly narrowed behind dorsal. Head short and thick, almost round. Mouth large, oblique, the jaws equal.

Barbel lateral, well developed. Eye small, 5 in head. Cheeks swollen. Scales larger than in *S. corporalis*, not much crowded forward. Lateral line much decurved. Dorsal fin entirely behind ventrals, its last ray over the first ray of the anal. Fins all small. Coloration of *S. corporalis*; the black dorsal spot distinct. Head  $3\frac{3}{4}$ ; depth 4. D. 8; A. 7; scales 9–48–5; teeth 2, 5–4, 2. L. 4 inches. Flint River, Georgia.

(Jordan, Bull. U. S. Nat. Mus. x, 63, 1877.)

\*\* Insertion of dorsal fin scarcely behind ventrals; scales nearly equal over the body; no conspicuous black dorsal spot. (Leucosomus Heckel.)

### 349. S. bullaris (Raf.) Jor. - Fall-fish; Silver Chub.

Body oblong, robust, little compressed. Head large, convex, the snout bluntly conic. Mouth large, terminal, somewhat oblique, the lower jaw included; premaxillary below the level of the eye, the maxillary barely reaching the front of the orbit. Eye moderate, rather high up and anterior,  $4\frac{1}{2}$  in head. Barbel shorter than pupil, not evident in young specimens. Scales large, 22 in front of dorsal, not crowded anteriorly. Dorsal fin slightly behind middle of body, just behind ventrals. Fins moderate. Coloration brilliant; steel-blue above; sides and belly silvery males in spring with the belly and lower fins rosy or crimson. Head 4; depth 4. D. 8; A. 8; scales 8-45-4; teeth 2, 5-4, 2. L. 18 inches. Largest of our Eastern Cyprinidæ. Abundant from Massachusetts to Virginia, east of the Alleghanies.

(Cyprinus bullaris Rafinesque, Amer. Month. Mag. and Crit. Rev. 1817, 120: Leuciscus argenteus and putchellus Storer, Rept. Fish. Mass. 1839, 90: Chilonemus pulchellus Storer, Fish. Mass. 286: Leucosomus cataractus Baird: Semotilus rhotheus Cope, Cypr. Penn. 362: Leucosomus putchellus Günther, vii. 438.)

### 96.—SYMMETRURUS Jordan.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 788, 1878: type *Pogonichthys argyrciosus* Girard.)

This genus differs from *Pogonichthys* chiefly in the caudal fin, which is developed as in *Semotilus* and other related genera, the two lobes equal, and the rudimentary basal rays comparatively few and small. The presence of grinding surface on the teeth and the position of the barbel chiefly distinguish *Symmetrurus* from *Semotilus*. (σόμμετρος, symmetrical; οὸρά, tail.)

# 350. S. argyriosus (Girard) Jor.

Body elongated, pretty strongly compressed. Head moderate, considerably compressed, the snort subconical. Mouth moderate, nearly horizontal, the lower jaw included, the maxillary reaching the front of

the eye. Eye large,  $3\frac{1}{4}$  in head. Scales moderate, very silvery. Lateral line slightly decurved. Fins rather high. Dorsal fin rather in advance of ventrals. Candal fin with its rudimentary rays few and little developed, the two lobes equal. Brownish above, with black dots; sides and below bright silvery. Head  $4\frac{1}{4}$ . D. 9; A. 8; Lat. l. 60; teeth 2, 5-(4, 2). L. 4 inches. Presidio, Cal.

(Pogonichthys argyreiosus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 154: Leucosomus argyreiosus Günther, vii, 267.)

# 97.—POGONICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 136; type Pogonichthys inæquilobus B. & G.=Lewiscus macrolepidotus Ayres.)

Body elongate. Head small, conical. Mouth moderate, terminal, normal; maxillary with a well-developed barbel; premaxillaries protractile. Teeth 2, 4–5, 2, or 2, 5–5, 2, hooked, with well-marked grinding surface. Scales rather large. Lateral line continuous, decurved. Dorsal fin beginning rather in advance of ventrals. Anal basis short. Caudal fin with its rudimentary rays numerous and greatly developed, supported by strong apophyses of the caudal vertebrae, the upper lobe of the fin considerably longer than the lower. Intestinal caual short; peritoneum brownish. Species of large size.  $(\pi \omega_{\ell} \omega_{\nu}, \text{beard}; i\chi \theta^{\lambda} \varepsilon, \text{fish.})$ 

# 351. P. macrolepidotus (Ayres) Jor.—Split-tail.

Body elongate, somewhat compressed, the back a little elevated, the form somewhat that of *Cycleptus*. Head short, slender. Mouth moderate, nearly horizontal, the maxillary reaching front of orbit; lower jaw included; preorbital longer than deep. Eye large,  $4\frac{1}{4}$  in head; interorbital space convex. Dorsal fin midway of the body, rather in front of the ventrals. Scales rather large, moderately imbricated. Lateral line decurved. Fins rather large; upper lobe of caudal half longer than head. Coloration uniform, somewhat silvery. Head  $4\frac{1}{5}$ ; depth  $3\frac{3}{4}$ . D. 9; A. 8; scales 10-66-6; Vert. 26+15; teeth 2, 5-5, 2. L. 12 inches. Rivers of California. Singularly distinguished from our other *Cyprinidæ* by the great development of the upper lobe of the caudal and its rudimentary rays.

(Pagonichthys inagnitobus Baird & Girard, Prec. Acad. Nat. Sci. Phila. 1854, 136 (August), and U. S. Pac. R. R. Surv. x, 245: Leucosomus inagnitobus Günther, vii, 271: Leuciscus macrolepidotus Ayres, Placer Times and Transcript, 1854, May 30; Jordan, Proc. U. S. Nat. Mus. 1850, 326.)

### 97 (b). STREODON Garman.

(Garman, Bull. Mus. Comp. Zoöl. viii, 90, 1881: type Stypodon signifer Garm.)

Body oblong, compressed, covered with large, deciduous scales. Lateral line complete, decurved. Dorsal and anal fins short. Mouth small,

anterior; premaxillaries protractile; fold of lower lip not crossing the symphysis; lower jaw trenchant, without horny covering; no barbels. Gill-rakers short. Pharyngeals strong. Teeth 3–3, of the *Mylochilus* type, more or less cylindrical, with rounded grinding surfaces, posterior more slender and subconical. (στόπος, stump; ἄδων, tooth.)

### 352. S. signifer Garman.

Dorsal and ventral outlines similar. Eye large, longer than snout. Mouth oblique, the maxillary not reaching front of eye. Lower jaw the longer. Pectorals not reaching ventrals, the latter to anal. Brown; silvery below; a broad brown lateral band, bordered above by a narrow silvery line. Head  $3_3^2$ ; depth  $3_3^2$ . D. 8; A. 8; scales 6-35-2; "teeth 3-3, stout, stump-like, with convex summits." Lago de Parras, an isolated lagoon in Coahuila, Mexico. (Garman.)

(Garman, l. c. 90.)

### 98.—MYLOCHILUS Agassiz.

(Mylocheilus Agassiz, Amer. Journ. Sci. Arts, 1855, 229; type Mylocheilus lateralis Agassiz = Leuciscus cauriuus Rich.)

Body elongate, not elevated, little compressed. Head rather short, conic, somewhat pointed. Mouth rather small, little oblique, the lower jaw included; maxillary with small barbel at its end; upper jaw protractile. Scales moderate not closely imbricated. Lateral line decurved. Dorsal fin beginning nearly opposite ventrals. Caudal fin with the rudimentary rays little developed. Anal basis short. Intestinal canal about as long as body. Teeth 2, 5–5, 2, or 2, 5–4, 2, two or three of those in the main row molar, much enlarged, blunt and truncate above. (A third deciduous row sometimes present, according to Girard, in this genus and in *Mylopharodon*; we have seen nothing of the kind.) Size large. (μύλος, grinder: χείλος, lip.)

#### 353. M. caurinus (Richardson) Grd.-Columbia Chub.

Eye large, shorter than snont, 5 in head; interorbital space broad, convex. Month horizontal or nearly so, the maxillary not reaching the front of the eye; suborbital bones wide; preorbital elongate. Color dark above; sides silvery, a dark lateral band; below this a pale stripe; under which is a dark stripe which extends about to the vent; fins plain; belly and pale stripe red in spring males. Head 4½; depth 4½. D. 8; A. 8; scales 13–70–10; teeth 2, 5–5, 2. In 12 inches. Streams

chiefly west of the Cascade Range, from California to British Columbia, often entering the sea: abundant.

(Cyprinus (Leuciscus) caurinus Richardson, Fanna Bor.-Amer. Fishes, 1836, 304; Mylocheilus latéralis, caurinus, and fraterentus Girard, U. S. Pac. R. R. Surv. x, 213-215; Leucosomus caurinus Giinther, vii, 270.)

### 99.-MYLOPISARODON Ayres.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 33: type Mytopharodon robustus Ayres = Gila conocephala Β. & G.)

Body elongate. Head large, pike-like, the upper jaw not protractile; no barbel. Teeth 2, 4–5, 2; two or three of the teeth in the main row molar, truncate or bluntly rounded at the apex, much enlarged. Mouth terminal, rather large, with thickened lips. Scales rather small. Lateral line continuous. Dorsal fin inserted behind the ventrals. Anal basis short. Size very large. This genus has been confounded with Mylochilus, from which it differs in the non-protractility of the upper jaw. (Shortened from  $Mylopharyngodon-\mu \dot{\nu} \lambda u z$ , grinder;  $\dot{\varphi} \dot{u} \rho u \gamma z$ , pharynx;  $\dot{u} \dot{v} \dot{u} \dot{u} \dot{u} z$ , tooth.)

### 354. M. conocephalus (Baird & Girard) Grd.

Body elongate, subfusiform, compressed. Head broad and depressed, the snout tapering, almost wedge-shaped. Mouth horizontal, the jaws about equal, the maxillary extending to eye. Eye small, about 7 in head,  $2\frac{1}{2}$  in snout; preorbital elongate. Interorbital space as long as maxillary, 3 in head. Scales rather small, of the type usual in the Pacific coast *Cyprinidæ*. Dorsal fin a little behind ventrals. Caudal fin  $1\frac{1}{2}$  in head; caudal peduncle very long,  $4\frac{1}{2}$  in length. Color dark, paler below. Head  $3\frac{1}{2}$ ; depth  $4\frac{2}{3}$ . D. 8; A. 8; scales 17-74-7. L. 18 inches. Rivers of California. Next to the species of *Ptychochilus* the largest of our *Cyprinidæ*.

(Gila conocephala B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 134: Mylopharodon vobustus Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 33: Mylopharodon conocephalus and robustus Grd. U. S. Pac. R. R. Surv. x, 216; Günther, vii, 262.)

#### 100.-PTYCHOCHILUS Agassiz.

(Ptychocheilus Agassiz, Amer. Jonru. Sci. Arts, 1855, 229: type Ptychocheilus gracilis Agassiz = Leuciscus oregoneusis Rich.)

Body elongated, little elevated, the caudal peduncle not contracted. Head long, slender, pike-like. Month nearly horizontal, widely eleft, the maxillary extending to below the eye, the upper lip rather below the level of the eye, the lower jaw included both anteriorly and laterally; no barbel; lips thick. Scales small, little imbricated, mostly

Bull, Nat. Mus. No. 16---15

longer than deep. Lateral line decurved. Dorsal fin well back, somewhat behind ventrals. Anal basis short. Caudal fin strong, its rudimentary rays not greatly developed. Intestinal canal short. Teeth 2, 5–4, 2; the straight limb of the pharyngeal bone extremely long and slender, its teeth wide apart, subconical, scarcely compressed, and but slightly curved at tip, the hook being turned in the direction of the angle of the bone; no trace of grinding surface. Fishes of very large size, reaching a length of more than 4 feet, the largest of the Leuciscine Cyprinidæ. With a general resemblance to Squalius and Gila, this genus differ strongly in the form of the pharyngeal bones and teeth. (πτοχή, fold; χείλος, lip; the skin of the mouth behind the jaws being folded.)

# 355. P. oregonensis (Rich.) Grd.—Sacramento "Pike."

Body comparatively robust, with stout caudal peduncle. Mouth large, the maxillary reaching middle of the eye. Eye small,  $2\frac{1}{2}$  in snout,  $7\frac{1}{2}$  in head; in young specimens the eye is proportionately much larger. Lateral line strongly decurved, much nearer belly than back. Coloration olivaceous; the fins in spring with red or orange; scales thickly punctate with dark dots. Head 4; depth 5. D. 8; A. 8; scales 12-73-6 (13-79-9 in Columbia River specimens); teeth 2, 5-4, 2 (in all specimens examined; not 2, 5-5, 2, nor 2, 4-4, 2). L. 3-5 feet. Rivers of the Pacific slope, chiefly west of the Sierra Nevada. Largest of our *Cyprinide*.

(Cyprinus (Lenciscus) oregonensis Richardson, Fauna Bor.-Amer. iii, 305, 1836: Ptychocheilus gracilis and major Agassiz, Amer. Journ. Sci. Arts, 1855, 229: Gila grandis Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 18: Ptychocheilus oregonensis and grandis Girard, U. S. Pac. R. R. Surv. Fish. 298-300: Lenciscus grandis and oregonensis Günther, vii, 239.)

#### 356. P. rapax Grd.

Body shorter and deeper than in Pt.oregonensis. Head similar, rather more depressed above. Mouth large, the maxillary reaching middle of eye. Lateral line moderately decurved, passing along the median line of the body between dorsal and ventrals. Dorsal inserted but little behind ventrals. Coloration dark; the sides somewhat clouded; fins plain. Head  $3\frac{2}{3}$ ; depth  $4\frac{2}{3}$ . D. 9; A. 8; Lat. l. 78. L. 12 inches. Monterey, California. Perhaps not distinct from the foregoing.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 209, and U. S. Pac. R. R. Surv. x, 300.)

## 357. P. harfordi Jov. & Gilb.

Form of P. oregonensis, but more slender, the lateral line similarly much decurved. Scales much smaller than in P. oregonensis. Caudal less deeply forked, the pectoral longer, reaching  $\frac{3}{5}$  to ventrals. Head 4;

depth 53. D. 8; A. 7; scales 17-90-9; teeth 2, 5-4, 2. L. 30 inches. Sacramento River, with *P. oregonensis*, but less common in the markets. (Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881.)

#### 358. P. lucins Grd.—Colorado " Pike".

Body slender, elongate, with long, slender, depressed head; the form and general appearance being that of *Pt.oregonensis*. Maxillary reaching past anterior margin of the eye. Eye small, 2½ in snout, 7 in head. Lateral line very strongly decurved. Fins low, the dorsal evidently behind ventrals. Scales very small. Coloration plain, darker above. Head 3½; depth 5½. D.9; A.9; Lat. l. 104; teeth 2, 4–5, 2. Colorado River: abundant.

(Girard, Proc. Acad. Nat. Sci. Phila, 1856, 209, and U. S. Mex. Bound, Surv. Ichth. 65.)

#### 101.-GILA Baird & Girard.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila, 1853, 368: type Gila robusta B. & G.)

Body elongate, little compressed, the back arched, especially in the adult: the candal peduncle typically extremely long, slender, contracted, much narrower than the base of the caudal fin, which is widely forked, with its basal fulera very much developed. Head in typical species broad, depressed, its profile concave. Mouth large, horizontal, and overlapped by the broad snout. Dorsal fin behind the middle of the body, slightly behind ventrals. Anal basis short. Intestinal canal short. Seales very small, little imbricated, sometimes scarcely imbricate at all, longer than deep, especially posteriorly. No barbel. Pseudobranchia Teeth 2, 5-4, 2, close set, compressed and hooked, without present. grinding surface. Vertebræ about 46 (5 or 6 more than usual in Squalius). Intestinal canal short; peritoneum dusky. Species of large size, the typical form remarkably unlike the usual Cyprinoid type, but varying through a series of intermediate forms directly into Squalius, so that the genus is hardly distinguishable by any definite technical character, unless the greater number of vertebra be found constant. (Gila, the name of the river where the typical species was first obtained.)

\* Head depressed anteriorly, the occipital region high, so that the profile is notably concave.

## 359. G. elegans B. & G.

The extreme species of this type. Body elongate, somewhat compressed, the region before the dorsal elevated, forming a sort of hump, the dorsal fin inserted on the downward slope of the back, so that its base is quite oblique. Caudal peduncle extremely long and slender, as

broad as deen, and nearly terete, its length (from end of anal to middle of base of caudal) 11 times the length of the head, its least depth about one-seventh of its length, its extremity dilated and compressed. Head short, broad, the snout depressed and broadly rounded; the anterior part of the head from behind the eyes broad and depressed; the posterior part high, so that the profile forms a concave arc. Mouth rather large, nearly horizontal, the upper lip on the level of the lower part of orbit, the maxillary extending to the front of the orbit, the lower jaw on all sides included. Skin of the lower jaw hard. Eve small, anterior. Gill-rakers rather weak. placed low, 5 in head. Isthmus narrow. Fins all long and falcate. Pectorals reaching ventrals. Caudal fin deeply forked, its lobes long and pointed, the upper somewhat the longer; the rudimental basal rays strong, about 12 in number on each sides. Scales scarcely imbricated at all, on the caudal peduncle hardly touching each other, on the sides of the body much longer than deep; their texture thin and membranaceous; scales on back and belly much smaller than those on the sides. Coloration bluish above, pale below. Head 5; depth 5. D. 9; A. 10; scales 23-98-10; teeth 2, 4-5, 2. L. 12 Colorado and Gila Rivers. inches.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 369; Girard, U. S. Pac. R. R. Surv. x, 286: Leuciscus elegans Günther, vii, 241.)

#### 360. G. robusta Baird & Girard.

Body elongate, the back elevated and the head depressed as in *G. elegans*, but the caudal peduncle notably stouter, its least depth about one-third its length,  $3\frac{3}{4}$  in the length of the head. Month large, the upper lip on the level of the lower part of the orbit, the maxillary reaching past the front of the orbit. Fins rather lower than in *G. elegans*, the pectorals in the male reaching the ventrals, but falling short in the female. Eye small, low, anterior, 5–8 in head. Lateral line much decurved. Coloration plain. Head 4; depth 5. D. 9; A. 9; scales 17–90–10; teeth 2, 5–4, 2. L. 12 inches. Rio Colorado and Rio Gila.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 368, and U. S. Pac. R. R. Surv. x, 285: Leuciscus vobustus Giinther, vii, 241.)

#### 361. G. grahami Baird & Girard.

General form of the preceding, with similar head and candal peduncle, but with rather larger and more closely imbricated scales. Upper lip below level of eye, maxillary reaching front of orbit. Caudal fin less deeply forked, and pectorals not reaching nearly to ventrals. Colora-

tion plain, darker above. Head  $3\frac{2}{3}$ ; depth  $4\frac{1}{2}$ . D. 9; A. 9; Lat. l. 82. Rio Gila and Colorado Basin.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 389; Girard, U. S. Mex. Bound. Surv. Ichth. 61: Leuciscus grahami Günther, vii, 242: Ptychocheilus vorax Girard, Proc. Acad. Nat. Sci. Phila. 1856, 209, and U. S. Pac. R. R. Surv. x, 301. The type of "vorax" examined by us is a true Gila.)

#### 269. C. affinnis Abbott.

A species allied to the preceding, described as follows: "The body is slender, tail greatly attenuated, head constituting something more than one-fifth of the total length. Eye rather small, subelliptical, its diameter  $6\frac{1}{2}$  times in the entire length of the head. The posterior extremity of the maxillary extends to a vertical line drawn posteriorly to the anterior edge of the orbit. Anterior margin of the dorsal fin nearer the base of the caudal than the extremity of the snout. Anterior margins of the ventral fins somewhat nearer the extremity of the snout than the base of the caudal. The lateral line is nearly concurrent with the ventral outline. The numbers of the fin-rays are: D. 10; P. 16; V. 8; A. 9; C.  $28\frac{3}{3}$ ." (Abbott.) Dull violet above, pinkish below. Kansas River; Platte River. (We have some time since examined specimens from Platte River, and thought them distinct from G. robusta and G. grahami, but having lost our notes are unable to add to Dr. Abbott's account.)

(Abbott, Proc. Acad. Nat. Sci, Phila, 1860, 474.)

### 363. G. gracilis Baird & Girard.

Body slender, the back not much elevated, the caudal peduncle not very slender, about twice as long as deep. Head large, its upper profile not very strongly concave. Month large, terminal and oblique, the upper jaw scarcely longer than the lower, maxillary reaching past the front of the eye. Interorbital space broad. Pectorals falling considerably short of ventrals. Caudal deeply forked. Dorsal well behind ventrals. Head  $3\frac{1}{2}$ ; depth  $4\frac{1}{2}$ . D. 9; A. 9; Lat. l. 88. Gila and Colorado Rivers.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 369; Girard, U. S. Pac. R. R. Surv. x, 257; Leuciscus zunnensis Gfinther, vii, 241.)

#### 364. G. emorii Baird & Girard.

Body slender, the back not notably arched. Caudal peduncle very slender, its least depth about one-fifth its length. Head rather small, conic, scarcely depressed above the eyes, its profile continuous with that

<sup>\*\*</sup> Head conical, scarcely depressed, the profile not concave.

a. Belly scaled.

of the back. Mouth small, nearly terminal, the maxillary not reaching to the front of the orbit. Eye rather large, interior, not placed low. Scales small, especially on the back and belly, the exposed surfaces longer than deep. Fins large; the pectorals reaching ventrals; the caudal deeply forked. Dorsal fin inserted nearer the top of snout than to the base of caudal. Head  $4\frac{1}{8}$ ; depth  $4\frac{1}{2}$ . D. 9; A. 9; Lat. 1. 98. Rio Gila. (Girard.)

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 388; Girard, U. S. Mex. Bound. Surv. Ichth. 62: Leuciscus emorii Günther, vii, 242.)

### 365. G. nacrea Cope.

Body rather slender; profile and interorbital region gently convex. Maxillary not reaching line of orbit. Caudal peduncle slender, its least depth 4 in head. Eye 5 in head. Pectorals not reaching ventrals. Dorsal behind ventrals. Silvery white; back narrowly dark-shaded; pectoral fins pink. Head 4; depth  $4\frac{2}{5}$ . D. 9; A. 10; scales 21-?-13; teeth 2, 5-4, 2. Green River (Rio Colorado). (Cope.)

(Cope, Hayden's Geol Surv. Wyom. 1870, 441, 1872. aa. Belly scaleless.

### 366. G. seminuda Cope & Yarrow.

Body moderately deep, with slender and tapering caudal peduncle, the least depth of which is about one-third its length. Back little elevated, not arched in front of dorsal. Head small, transversely convex, its profile continuous with that of the back and not concave. Mouth rather small, oblique, terminal, the upper lip opposite the middle of the orbit, the maxillary not reaching the line of the orbit. Eye large, rather anterior, but not very low, its length 4 in head. Fins moderate. Dorsal slightly behind ventrals. Brownish above, lower fins pink. Head 5; depth 5\frac{3}{4}. D. 10; A. 10; scales 21-98-12; teeth 2, 5-4, 2. L. 6 inches. Rio Virgen, in Utah. (Cope.) This species forms a transition to Squalius and other normally formed Cyprinidæ.

(Cope & Yarrow, Zoöl, Wheeler's Expl. W. 100th Mer. v, 666, 1876.)

#### 102.—SQUALIUS Bonaparte.

### Dace.

(Telestes Bonaparte; Cheonda, Tigoma, Siboma, and Clinostomus Girard.)
(Bonaparte, Fauna Italica, 1837, ¶ 6: type Cyprinus leuciscus L., the European "Dace".)

Body oblong, compressed or robust, covered with moderate or small scales, which are not closely imbricated. Lateral line complete, decurved. Mouth large or small, usually terminal, the lips normal, without barbel. Teeth mostly 2, 5-4, 2, sometimes 2, 5-5, 2, or 1, 5-4, 2,

hooked, with narrow grinding surface or none. (Grinding surface present in *Squalius leueiscus*, obsolete in most of our species.) Anal basis short or somewhat elongate. Dorsal fin posterior, usually behind ventrals. Intestinal canal short. Size generally large. A very large group, one of the largest current genera in ichthyology, represented by numerous species in the rivers of Europe, Asia, and North America. Most of our species have been poorly defined. The majority of Girard's original types have been preserved, and the descriptions here given are mainly taken from them. Much larger series of each form are necessary before the species can be properly discriminated. Individual irregularities in dentition are common in this genus. (From *squalus*, a shark; some early writers on ichthyology having called the typical species *Squalus minor*, for no evident reason.)

The species may be divided as follows:

- \* Teeth normally without grinding surface.
  - tCaudal peduncle not very stout, its least depth not two-thirds the length of the
    - † Month very wide, the lower jaw much projecting beyond upper, the upper lip on the level of the middle of the pupil, and the maxillary reaching to below the pupil; body clongate, compressed; dorsal well backward (CLINOSTOMUS Grd.).....elongatus, vaudoisulus, estor, funduloides.
    - the Mouth moderate or small, terminal, oblique, the lower jaw little projecting, premaxillary below the level of the pupil, and the maxillary not reaching to the pupil. (TIGOMA Grd.)
      - a. Anal basis elongate, its rays 10-12....hydrophlox, twnia, montanus, humboldti. aa. Anal basis short, its rays 8 or 9.
        - b. Scales in lateral line 50-65.

cruoreus, ardesiacus, pandora, margaritus, gula, pulcher, egregius, lineatus, gracilis, conformis, bicolor, obesus, purpureus.

bb. Scales in lateral line 65-80.

pulchellus, intermedius, alicia, copci, niger, conspersus.

- \*\* Teeth with evident grinding surface. (SQUALIUS.)
  - c. Robust species, the depth 3-31 in length; lateral line less than 60.

rhomaleus, squamatus, atrarius, crassus.

- ce. Slender species, the depth 4-4\frac{1}{4} in length; lateral line 60-70 (Cheonda Grd.) ... ... coruleus, cooperi, nigrescens, modestus.
- \* Teeth (normally) without grinding surface (various irregularities often present, so that the character has little value).
  - t Caudal peduncle not very stout, its least depth not two-thirds the length of the head.
    - † Mouth very wide, the lower jaw much projecting beyond upper, the upper lip on the level of the middle of the pupil, and the maxillary reaching to below the pupil; body elongate, compressed; dorsal well back. (Clinostomus Girard.\*)

<sup>\*</sup>Girard, Proc. Acad. Nat. Sei. Phila. I856, 211: typo Luxilus elongatus Kirtland ( $\varkappa\lambda\acute{\nu}\omega$ , to incline:  $\sigma\acute{\tau}\acute{\rho}\mu\alpha$ , mouth.)

### 367. S. elongatus (Kirtland) J. & G.—Red-sided Shiner.

Body elongate, compressed. Head long, rather pointed. Month very large, oblique; the lower jaw notably projecting, with a small knob at the symphysis; upper lip on the level of the pupil; maxillary extending to the middle of the orbit; posterior angle of opercle acute. Eye moderate, nearly 4 in head. Scales very small. Fins short and high, the dorsal somewhat behind ventrals. Lateral line decurved. Color dark bluish; the scales mottled with paler; sides with a broad black band; belly more or less silvery; the front half of the lateral band bright crimson in spring males; the belly and lower fins more or less reddened; a dark vertebral band. Head 4; depth 5. D. 8; A. 9; scales 10–70–5; teeth 2, 4–5, 2. L. 5 inches. Great Lakes and Upper Mississippi Valley, chiefly from Pennsylvania to Minnesota.

(Luxilus elongatus Kirtland, Rept. Zoöl. Ohio, 169, and in Bost. Journ. Nat. Hist. iii, 339: Leuciscus elongatus Giinther, vii, 245: Clinostomus elongatus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 212: Gila elongata Jordan, 300: Clinostomus proriger Cope, Cypr. Penn. 375: Leuciscus proriger Giinther, vii, 245: Gila proriger Jordan, 300 (may be a different species; sides more compressed and more silvery; Lat. l. 63; teeth 2, 4-5, 1; common, with the other.)

#### 368. S. vandoisulus (Val.) Jor & Gilb.

Body oblong, deep and compressed. Head rather large. Mouth large, oblique, the lower jaw projecting, and the mandible extending to the pupil. Eye moderate,  $3\frac{1}{2}$  in head. Lateral line decurved. Color bluish green; some of the scales of the back irregularly darker, producing a mottled appearance; no dark lateral band; males in spring with the region behind the head and above the pectorals as far back as the anal of a bright rose-red, brightest anteriorly. Head  $3\frac{2}{3}$ ; depth  $3\frac{2}{3}$ . D. 9; A. 8; Lat. l. 53; teeth 2, 5–5, 2. L. 5 inches. Virginia to Georgia; abundant.

(Leuciscus randoisnlus Cuv. & Val. xvii, 317: Clinostomus affinis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 212: Leuciscus randoisulus Giinther, vii, 256: Leuciscus affinis Gunther, vii, 257: Clinostomus affinis Cope, Journ. Acad. Nat. Sci. Phila. 1868, 228: Gila vandoisula Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 24.)

#### 369. S. estor Jordan & Brayton.

Body elliptical-elongate, compressed, the caudal peduncle rather long, but not so long as head. Head very long and large, flattish, but not broad above. Mouth larger than in any other of our *Cyprinidæ*, very oblique, the upper jaw on the level of the pupil, the maxillaries extending to opposite the middle of the orbit, the length of the gape a little more than half the length of the head, the lower jaw considerably the longer. Eye rather large, less than snout, 4 in head. Scales mod-

erate. Lateral line strongly decurved; 23 series of scales in front of dorsal fin. Fins high. Color dark olive above, many scales irregularly darker; sides silvery; no dark lateral band; a broad shade of deep rose-color along the sides in spring males, below which most of the belly is bright crimson, these red colors brightest anteriorly. A narrow, dark lateral streak like a pencil-mark, from head to tail, overlaid by the scales. Head 33; depth 44. D. 8; A. 8; scales 8–50–5; teeth 2, 5–4, 2. L. 4 inches. \*Cumberland and Tennessee Rivers.

(Gila estor Jordan & Brayton, Bull, U. S. Nat, Mus, xii, 66; Gila estor Jordan, 300.)

# 370. S. funduloides (Grd.) Jor. & Gilb.

Body rather elongate, somewhat compressed, with arched back and rather slender caudal peduncle, the latter longer than head. Head moderate, smaller than in any of the preceding species. Mouth as in the preceding, but less deeply cleft. Eye large, 3 in head. Dusky above; a dark lateral band, with a narrower pale streak above it; belly and lower part of head yellowish, red in males in spring. Head 4¼; depth 4¼. D. 8; A. 8; scales 9–48–4; teeth 2, 5–4, 2. Streams tributary to Chesapeake Bay, south to North Carolina. (Cope.)

(Clinostomus funduloides and carolinus Grd. Proc. Acad. Nat. Sci. Phila. 1856, 212: Clinostomus funduloides Cope, Cypr. Penn. 376: Leuciscus funduloides Giinther, vii, 256.)

- th Mouth moderate, terminal, oblique, the lower jaw little projecting, the premaxillary below the level of the pupil, and the maxillary not reaching to pupil. (Tigoma Girard.\*)
  - a. Anal basis elongate, its rays 10-12.

## 371. S. hydrophlox (Cope) Jor. & Gilb.

Body rather slender. Head small; front straight. Month rather small, oblique, the maxillary just reaching line of orbit, lower jaw projecting. Eye small, 5 in head,  $1\frac{1}{2}$  in interorbital width. Anal fin long. Color olive above, with a dusky lateral border, below this a crimson band, and still lower a blackish band, which runs above the lateral line to the base of the caudal fin; cheeks, sides, and belly crimson anteriorly in males, silvery in females. Head  $4\frac{3}{4}$ ; depth  $4\frac{1}{2}$ . D. 8; A. 11; scales 15-58-7; teeth 2,5-4,2. L. 6 inches. Blackfoot Creek, Idaho. (Cope.) A species intermediate between the typical Clinostomi and the Tigomæ, closely related to S. montanus, etc.

(Clinostomus hydrophlox Cope, Hayden's Geol. Surv. Mont. 1871, 475, 1872.)

<sup>\*</sup>Girard, Proc. Acad. Nat. Sci. Phila. 1856, 205: type Gila puchella B. & G. (A coined name.)

### 372. S. tænia (Cope) J. & G.-Leather-sided Minnow.

Body rather elongate, but deep and compressed, formed as in *Clinostomus* proper. Head rather small, short, compressed, but broad above, the jaws equal. Month oblique, short, the maxillary reaching the front of the orbit, the upper lip opposite middle of orbit. Eye large,  $3\frac{1}{5}$  in head, equal to interorbital space. Lateral line decurved; 33 scales in front of the dorsal fin. Coloration greenish silvery; the back dusky; a blackish lateral band, between two silvery stripes; the lateral band and below bright orange, red in the males. Head  $4\frac{1}{3}$ ; depth 4. D. 9; A. 10 or 11; scales 12–58–5. L. 3–5 inches. Salt Lake Basin; abundant in Provo River. Very close to the next, differing in shorter anal and rather deeper body.

(Clinostomus tania Proc. Amer. Phil. Soc. Phila. 1874, 133: Gila tania Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 658.)

## 373. S. montanus (Cope) J. & G.

Body rather slender. Muzzle decurved, obtuse, but less so than in *S. twnia*. Jaws equal; end of maxillary extending beyond margin of orbit. Eye large,  $3\frac{1}{2}$  in head, equal to interorbital space. Anal fin elongate. Lateral line decurved. Olive above; a dark lateral band; sides crimson in males. Head 4; depth 4. D. 9; A. 12; scales 12–56–6. L.  $3\frac{1}{2}$  inches. Idaho to Arizona; abundant in the Utah Basin, with the preceding.

(Clinostomus montanus Cope, Hayden's Geol. Surv. Mont. 1871, 476, and Proc. Acad-Nat. Sci. Phila. 1874, 136: Gila montana Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 657.)

#### 374. S. humboldti (Grd.) J. & G.

Body short and deep. Head moderate. Mouth terminal, oblique, the eleft rather short, the maxillary reaching front of eye. Eye large, 4 in head. Lateral line little decurved. Dorsal fin rather behind ventrals. Anal fin rather elongate. Color bluish; sides with two dusky lateral bands. Scales large. Head 4; depth 3. D. 8; A. 12; scales 12–56–8; teeth 2, 4–5, 1. Humboldt River, Nevada.

(Tigoma humboldti Grd. Proc. Acad. Nat. Sci. Phila. 1856, 206, and U. S. Pac. R. R. Surv. x, 291.)

aa. Anal basis short, its rays 8-9.
 b. Scales in lateral line 50-65.

#### 375. S. cruoreus J. & G.

Body moderately elongate, symmetrical, not strongly compressed. Head broad, rounded above, maxillary reaching front of eye. Eye rather large,  $4\frac{1}{2}$  in head. Lateral line running low. Dorsal a little behind ventrals, scarcely nearer base of caudal than snout. Caudal

evenly forked. Pectorals short, not reaching nearly to ventrals; ventrals to vent. Dasky bluish; sides dark; a red spot at bases of ventrals and anal. Head 4; depth 4. D. 9; A. 8; scales 11–56–6; teeth 2, 5–4, 2. L. 6 inches. Utah Lake.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 461.)

### **376. S. ardesiacus** (Cope) J. & G.

Body rather stout, compressed. Head heavy, muzzle short. Month short, very oblique, the jaws about equal, the maxillary reaching past the front of the large eye. Eye 4 in head. Pectoral fin long, nearly reaching anal. Olivaceous above; a narrow dark lateral band, following the direction of the back. Anal fin short. Head  $3\frac{1}{2}$ ; depth  $4\frac{1}{5}$ . D. 8; A. 8; scales 17–63–8; teeth 2, 5–4, 2. L. 4 inches. Exact locality unknown; probably Nevada.

(Gila ardesiaca Cope, Zoöl, Wheeler's Expl. W. 100th Mer. v, 660.)

## 377. S. pandora (Cope) J. & G.—Chub of the Rio Grande; Pescadito.

Body fusiform. Head small, broad and rather flat at the muzzle. Jaws equal, maxillary not reaching line of orbit. Eye small, 64 in head. Dorsal fin posterior. Silvery, darker above. A broad, ill-defined lateral band. Physiognomy of Ceratichthys rather than of Squalius. Head 4; depth 45. D. 8; A. 8; scales 17-61-9 (17-59-10 to 18-65-11); teeth normally 2, 5-4, 2, sometimes 2, 4-4, 2, or even 1, 4-4, 1, in abnormal or immature specimens; the second tooth sometimes with a small grinding surface. L. 8 inches. Rio Grande region. "The most abundant fish in New Mexico," and quite variable in characters usually very constant among these fishes.

(Clinostomus pandora Cope, Hayden's Geol, Surv. Mont. 1871, 475.)

#### 378. S. margaritus (Cope) J. & G.

Body stout and thick, little compressed, the back somewhat elevated. Caudal peduncle thick. Head blunt, thick and rounded. Mouth small, terminal, oblique, the upper lip below the orbit, the maxillary not reaching the line of the orbit. Eye rather large. Scales rather small. Lateral line decurved. Fins rather large. Dorsal fin posterior. Coloration above dusky olive; sides plumbeous silvery; belly white, crimson in spring males; snout dusky; fins plain; scales punctate. Head 4; depth 4. D. S; A. 8; scales 11–58–8; teeth 2, 5–4, 2. L. 3 inches. Susquehanna River. A handsome fish, quite unlike any other American species, resembling most *Phoxinus neogens*.

(Clinostomus margarita Cope, Cypr. Penn. 1866, 377: Leuciseus margarita Günther, vii, 246.)

## 379. S. gula (Cope) J. & G.

Body rather robust, heavy anteriorly. Head large, with wide front and broad, oblique mouth; maxillary reaching front of eye. Eye 5 in head, 2 in interorbital width. Dorsal fin posterior. Color dusky above; belly silvery; axils of fins crimson in males. Head 3½; depth 4½. D. 8; A. 8; scales 16–60–11; teeth 2, 5–4, 2. L. 7 inches. New Mexico. (Cope.)

(Gila gula Cope, Zoöl, Wheeler's Expl. W. 100th Mer. v. 661.)

### 380. S. pulcher (Grd.) Jor. & Gilb.

Body rather slender, little compressed. Head rather long and pointed. Mouth oblique, terminal, the jaws about equal, the maxillary barely reaching the front of eye. Scales moderate. Lateral line decurved. Fins large. Dorsal behind ventrals, its tip when depressed reaching the posterior base of the anal. Pectorals nearly reaching ventrals. Coloration brilliant; dusky above; sides and belly golden (red in life?); sides with a vague dusky band. Head  $3\frac{1}{5}$ ; depth  $4\frac{1}{3}$ . D. 8; A. 8; scales 13–63–7; teeth 1, 4–4, 1, without grinding surface. L. 6 inches. Chihuahua River. A handsome species, resembling Squalius cæruleus, but with the fins larger and the number of teeth different. Although Girard places this fish among the Tigomæ with grinding surface on the teeth, we are unable to find such surface on his typical specimens. All that we have examined have the teeth sharp, and 1, 4–4, 1. If this dentition is constant, it may be necessary to refer S. pulcher to a different genus.

(Tigoma pulchra Girard, Proc. Acad. Nat. Sci. Phila, 1856, 207, and U. S. Mex. Bound, Surv. Ichth, 65.)

### 381. S. egregius (Grd.) J. & G.

Body rather elongate, subfusiform. Head moderate. Snout thickish, subconical. Mouth oblique, the jaws equal, the maxillary reaching front of orbit. Eye moderate,  $4\frac{1}{2}$  in head. Lateral line not much decurved. Color bluish black; sides with two irregular bands of dark spots; the interspace red in males. Head 4; depth 4. D. 8; A. 9; Lat. 1. 65. Great Basin; exact locality unknown.

(Tigoma egregia Grd. U. S. Pac. R. R. Surv. x, 291.)

### **382. S. lineatus** (Grd.) J. & G.

Body elongate, subfusiform. Head moderate. Snout subconical. Month oblique, lower jaw somewhat included, maxillary reaching to orbit. Dorsal fin posterior. Scales small. Lateral line with an open

curve, running unusually low. Yellowish; above dusky, with darker spots and narrow dark lines. Head  $4\frac{1}{4}$ . D. 8; A. 8. Utah Basin; exact locality not known. (Girard.)

(Tigoma lineata Girard, Proc. Acad. Nat. Sci. Phila, 1856, 206, and U. S. Pac. R. R. Surv. x, 292.)

### 383. S. gracilis (Grd.) J. & G.

Described as still slenderer and with still smaller scales than in *S. lineatus*. Lateral line little decurved. Snout subconical, rather short. Coloration plain, dusky above, paler below. D. 8; A. 7. Exact locality unknown; probably from Utah. (*Girard*.)

(Tigoma gracilis Grd. Proc. Acad. Nat. Sci. Phila, 1856, 206.)

### 384. S. conformis (B. & G.) J. & G.

Body robust, rather elevated. Head moderate, the mouth rather small, oblique, maxillary not quite reaching eye. Eye moderate, nearly 5 in head. Dorsal fin considerably behind ventrals. Scales large. Lateral line decurved. Purplish brown above, yellowish below. Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ . D. 8; A. 8; scales 9–52–5; teeth 2, 4–?, ?. L. 4 inches. Tulare Valley, California.

(Lavinia conformis B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 137: Tigoma conformis Grd. U. S. Pac. R. R. Surv. x, 289.)

### 385. S. bicolor (Girard) J. & G.

Body robust, heavy anteriorly, tapering backward. Head long. Mouth large, the maxillary reaching to the eye. Eye small, 6 in head. Scales rather large. Lateral line decurved. Dorsal fin inserted almost directly over ventrals. Fins rather small. Dusky above, sides and below silvery. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ . D. 8; A. 8; scales 13-64-6; teeth 2, 5-5, 2. L. 12 inches. Klamath Lake, Oregon.

(Tigoma bicolor Grd. Proc. Acad. Nat. Sci. Phila, 1856, 206, and U. S. Pac. R. R. Surv. x, 280.)

## 386. S. obesus (Grd.) J. & G.

Body short and compact, the caudal peduncle rather slender. Head small, the short and rounded. Month moderate, maxillary reaching to eye. Eye moderate,  $4\frac{1}{4}$  in head. Dorsal fin smaller than anal, nearly median. Scales moderate. Lateral line little deflected. Bluish gray above, yellowish below. Head  $4\frac{1}{4}$ . D. 8; A. 9. Salt Lake Valley. (Girard.)

(Tigoma obesa Grd. Proc. Acad. Nat. Sci. Phila, 1856, 206, and U. S. Pac. R. R. Surv. x, 290.)

### 387. S. Durdureus (Grd.) Jor.

Stout and compressed. Head long. Lateral line decurved. Dorsal fin slightly behind ventrals. Fins all small. Blackish above, pale below. Head  $3\frac{1}{3}$ ; depth  $3\frac{3}{4}$ . A. 8; scales 13-62-8; teeth 2, 4-?, ?. San Bernardino, Mexico.

(Tigoma purpurea Grd. Proc. Acad. Nat. Sci. Phila. 1856, 206.)

bb Scales in lateral line 65-80.

#### 388. S. pulchellus (B. & G.) J. & G.

Body long and slender, the caudal pedancle rather narrow, but not specially contracted. Head slender, rather pointed. Mouth moderate, somewhat oblique, the maxillary scarcely reaching to the eye. Lateral line strongly decurved. Fins high, the dorsal somewhat behind ventrals. Eye 4½ in head. Grayish; two dusky lateral streaks; belly white. Head 4; depth 4½. D. 8; A. 8; Lat. l. 66; teeth 2, 5–4, 2. Rio Mimbres, a tributary of Lake Guzman, in Mexico.

(Tigoma pulchella Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 29: Tigoma pulchella Grd. U. S. Mex. Bound, Surv. Ichth. 62.)

#### 389. S. intermedius (Grd.) J. & G.

"Intermediate between S. pulchellus and S. purpureus, much nearer the former than the latter." Similar to the preceding. The caudal peduncle slender. Dorsal fin somewhat behind ventrals. Fins small. Coloration silvery, with dark dots. Head 3\(^3\); depth 4. D. 8; A. 9; scales 15-73-9. Rio Gila.

(Tigoma intermedia Grd. Proc. Acad. Nat. Sci. Phila, 1856, 206.)

#### 390. S. aliciae Jouv.

Body elongate, little compressed, the dorsal and ventral outlines similar. Head short, rather stout, its breadth  $\frac{3}{5}$  its length. Shout rounded, jaws equal, the maxillaries reaching front of eye. Eye 4 in head. Pectoral fin as long as head, not reaching ventrals. Dark plumbeous above, with a median steel-blue lateral band; belly pinkish; cheeks silvery. Head  $4\frac{1}{3}$ ; depth  $4\frac{1}{3}$ . D.8; A.8; scales minute, 18–80–15. Utah Lake.

(Jony, Proc. U. S. Nat. Mus. 1881, x.)

#### 391. S. copei Jordan & Gilbert.

Body comparatively elongate and compressed, the caudal peduncle long and rather slender. Head short, rather broad and flattish above, the interorbital space convex and broader than the eye. Eye moderate, as long as snout,  $3\frac{1}{2}-4$  in head. Mouth rather small, low, terminal, ob-

lique, the premaxillary just below the level of the pupil, the maxillary reaching to just below the level of the eye. Dorsal fin inserted somewhat behind ventrals. Pectorals short, not reaching nearly to ventrals, the latter not to the vent. Scales very small. Lateral line somewhat decurved. Bluish olive above, with dark points; a dusky lateral shade; fins nearly plain; axils red in the males. Head  $4\frac{1}{4}$ ; depth  $3\frac{3}{4}$ . D. 8; A. 8; scales about 19–80–12; teeth 2, 5–4, 2, typically without grinding surface, but subject to an unusual amount of irregularity, occasionally 2, 4–4, 1 or 2, and sometimes with grinding surface. L. 6 inches. Rio Grande and basin of Utah; very abundant. Described from specimens from Bear River, Wyoming.

(Gila egregia Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 662 (not Tigoma egregia Girard, as Girard's original specimens have Lat. l. 65); Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 461.)

## 392. S. niger (Cope) J. & G.

Body robust, the back elevated anteriorly, the caudal peduncle shortish and not very stout. Occiput depressed. Head large. Eye rather large, 5 in head. Mouth large, moderately oblique, the lower jaw included, the maxillary extending to the pupil. Fins small, the dorsal well backward. Scales small, posteriorly smaller and more crowded. Lateral line little decurved. Color dusky, the scales with black dots. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ . D. 8; A. 8; Lat. l. 80; teeth 2, 4–5, 2, said by Girard to have a developed grinding surface, which, however, we are unable to find. Rio Gila. A well-marked species, approaching the genus Gila.

(Gila gibbosa B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 28: Tigoma gibbosa Girard, Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Mex. Bound. Surv. Ichth. 64: †Gila nigra Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 633. The name gibbosa is, unfortunately, preoccupied.)

#### 393. S. conspersus (Garm.) J. & G.

Form of *S. niger*. Profile of head coneave, maxillary reaching front of orbit. Pectorals extending three-fourths distance to ventrals, which reach vent. Brown above; scales of back and sides speckled with darker; an obscure dusky lateral shade. Head  $3\frac{\pi}{4}$ ; depth  $3\frac{\pi}{4}$ . D. 8;  $\Lambda$ . 8; "teeth 4, 1–1, 4, clawed"; scales 13–69–9. Nazas River. (*Garman*.)

(Gila conspersa Garman, Bull. Mus. Comp. Zoöl. viii, 1881, 91.)

the Caudal pedimicle very deep and compressed, its depth nearly equal to the depth of the head; dorsal over ventrals; scales rather large. (Siboma Girard.)

### 394. S. gibbosus (Grd.) J. & G.-Mullet; Chub.

Body short, deep, compressed, the antedorsal region arched, the caudal peduncle nearly as deep as long, about as deep as the head.

Head conic, the profile steep, the muzzle short and rather pointed. Mouth small, oblique, the jaws nearly equal, the upper lip on the level of the lower part of the pupil, the maxillary scarcely reaching to front of eye: isthmus very narrow; preorbital nearly as deep as long. Eye small, anterior, 5 in head. Fins low. Dorsal fin opposite ventrals. nearer candal than snout; caudal fin short, little forked, scarcely broader than the very deep caudal peduncle, the spines of the caudal vertebrae very strong. Scales large, rather closely imbricated, their exposed surfaces rather deeper than long; 26 scales before dorsal. Lateral line decurved. Color brownish: sides white; young spotted above; scales everywhere with dark dots; fins plain. Head 41; depth 3. D. 8; A. 8; scales 9-56-7; teeth 2, 5-4, 2. L. 12 inches. Rivers of California; very abundant. One of the most peculiar of our Cyprinide, but hardly constituting a distinct genus.

(Lavinia crassicauda Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 137 (August): Siboma crassicauda Girard, Proc. Acad. Nat. Sci. Phila. 1856, 208, and U. S. Pac. R. R. Surv. Fish. 296: Leuciscus crassicauda Giinther, vii, 243: Leuciscus gibbosus Ayres, Daily Placer Times and Transcript, May 30, 1854: Lavinia gibbosa Ayres, Proc. Cal. Acad. Sci. 1854, 20.)

\*\* Teeth with evident grinding surface.\* (Squalius.)

c. Robust species; depth 3 to 31 in length; lateral line less than 60.

#### 395. S. rhomaleus Jor. & Gilb.

Body very robust, elevated anteriorly, the sides compressed, although the back is very broad. Head broad, the profile concave as seen from the side, the interorbital space flattish, scarcely raised above the eye. Snout broad, elevated at tip, premaxillary on the level of pupil. Mouth very oblique, the mandible much projecting, maxillary reaching front of eye. Eye small, anterior, 13 in snout, 7 in head; isthmus very narrow. Scales large, subequal, broadly exposed, firm. Lateral line decurved. Dorsal nearly median, inserted directly over ventrals. Caudal evenly forked, the peduncle long and deep. Pectorals short, extending three-fifths the distance to ventrals, ventrals about to vent. Lower fins short. Color blackish; everywhere dark. Head 3½; depth 3½. D. 9; A. 8; scales 10–55–5; teeth 2, 5–4, 2, short and stout, one of them with grinding surface. L. 12 inches. Utah Lake. One of the largest and best marked species.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 461.)

<sup>\*</sup> A variable character in this group.

### **396. S. squa**matus (Gill) J. & G.

Body very robust, subovate, compressed. Head large and long, conical. Mouth rather large, oblique, terminal, the maxillary reaching front of orbit, the upper lip on the level of the lower part of the eye. Eye moderate, anterior,  $5\frac{9}{3}$  in head. Dorsal fin small, inserted posteriorly, but directly over the ventrals. Scales moderate, suborbicular, widely exposed. Color dark or blackish; the scales all margined with black; fins dusky. Head  $3\frac{1}{3}$ ; depth 3. D. 8; A. 8; scales 10–53–6; teeth 2, 5–4, 2. L. 8 inches. Salt Lake Basin.

(Tigoma squamata Gill, Proc. Bost. Soc. Nat. Hist. 1861, and Ichth. Capt. Simpson's Expl. 1876, 405.)

# 397. S. atrarius (Grd.) Jor. & Gilb.—Utah Mullet; Chub of Utah Lake.

Body rather stout, the caudal peduncle not slender. Head moderate, subconical. Mouth anterior, quite small, the maxillary not reaching to the eye. Eye small,  $5\frac{1}{2}$  in head. Fins quite small. Dorsal fin nearly or quite over the ventrals. Scales large, not much imbricated, 25 before dorsal. Lateral line decurved. Olivaceous, blackish above, the color formed of small black points. Head 4; depth  $3\frac{4}{5}$ . D. 9; A. 8; scales 11-57-6; teeth 2, 5-4, 2, usually with evident grinding surface, although placed by Girard and Cope in Siboma, which wants such surface. L. 20 inches. Utah Basin. Very common in Utah Lake. A large species, used as food, and very destructive to young trout.

(Siboma atraria Grd. Proc. Acad. Nat. Sci. Phila. 1856, 208, and U. S. Pac. R. R. Surv. x, 297; Siboma atraria and var. longiceps Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 667.)

#### 398. S. crassus (Grd.) Jor. & Gilb.

Body robust. Head rather small, the snout short and depressed. Mouth moderate, oblique, the maxillary not reaching to the eye. Eye small, 6 in head. Dorsal fin inserted slightly behind ventrals. Scales moderate, broadly exposed. Dusky above, sides and below paler. Head 4; depth 3½. D. 8; A. 8; scales 10–57–7; teeth 2, 5–4, 2, with narrow grinding surface. L. 10 inches. Sacramento River, California.

(Tigoma crassa Grd, Proc. Acad. Nat. Sci. Phila, 1856, 207, and U. S. Pac, R. R. Surv. x, 293.)

cc. Slender species, the depth 4-44 in length; lateral line 60-70. (Cheonda\* Grd.)

#### 399. S. cærnieus (Grd.) Jor. & Gilb.

Body slender, subfusiform. Head slender, the snort long, conical,

<sup>\*</sup> Cheonda Girard, Proc. Acad. Nat. Sci. Phila. 1856, 207: type Cheonda cooperi Grd. (A coined name.)

Bull. Nat. Mus. No. 16----16

rather flattened above. Jaws equal, the maxillary reaching to orbit. Dorsal fin inserted behind ventrals. Anal fin quite small. Scales rather small. Dusky bluish above, pale below; scales everywhere with fine punctulations. Head  $3\frac{3}{4}$ ; depth  $4\frac{1}{4}$ . D. 9; A. 7; scales 13-61-7; teeth 2, 5-5, 2, with narrow grinding surface. Lost River, Oregon.

(Cheonda corulea Grd, Proc. Acad. Nat. Sci. Phila, 1856, 207, and U. S. Pac. R. R. Surv. Fish, 295.)

### 400. S. cooperi (Grd.) Jor. & Gilb.

Body elongate, subfusiform. Head moderate, the snout thickish, subconical, slightly projecting. Mouth oblique, the maxillary not quite reaching to the eye. Eye large,  $4\frac{1}{2}$  in head. Fins large, the anal notably so. Dorsal somewhat behind ventrals. Coloration plain, rather pale. Head  $4\frac{1}{3}$ ; depth  $4\frac{1}{4}$ . D. 8; A. 10; Lat. l. 63. Columbia River.

(Cheonda cooperi Grd. Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Pac. R. R. Surv. Fish. 294: Leuciscus cooperi Günther, vii, 243.)

## 401. S. nigrescens (Grd.) Jor. & Gilb.

Body rather elongate, subfusiform. Head long and rather pointed. Caudal peduncle long. Mouth terminal, oblique, the maxillary searcely reaching to eye. Snout prickly in male specimens. Fins moderate, the dorsal slightly behind ventrals. Color very dark, the sides with black spots, the scales with fine punctulations. Head  $3\frac{1}{2}$ ; depth 4. D. 8; A. 7; scales 16–70–10; teeth 2, 4 (–5, 2?). Boca Grande and Janos River.

(Tigoma nigrescens Grd. Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Mex. Bound. Surv. Ichth. 64.)

### 402. S. modestus (Garm.) J. & G.

Brownish, paler below; flanks not lustrous as in *S. nigrescens*. Form moderately stout, the outlines regular. Dorsal behind ventrals, its free border convex. Anal truncate. Distinguished from *S. nigrescens* by the greater length and the shape of the head, and a difference in the position of the dorsal. Head  $3\frac{1}{2}$ ; depth  $3\frac{3}{4}$ . D. 8; A. 8; scales 14–65–9. Saltillo, Coahuila.

(Cheonda modesta Garman, Bull. Mus. Comp. Zoöl. viii, 92, 1881.)

#### 103.—PHOXINUS Agassiz.

#### Minnows.

(Agassiz, Mém. Soc. Nat. Hist. Neufchâtel, i, 37, 1837: type Cyprinus phoxinus L. = Phoxinus lævis Ag.; the common "Minnow" of Europe.)

Body stout. Mouth normal, without barbel. Teeth 2, 5-5, 2, or 2, 5-4, 2, hooked, without grinding surface. Scales usually small, little

imbricated. Lateral line incomplete or wanting. Dorsal fin behind ventrals. Anal basis short. Species of small size and brilliant coloration; found both in Europe and America. ( $\varphi \sigma \tilde{\xi} \tilde{\iota} z \sigma \xi$ , a minnow; from  $\varphi \sigma \tilde{\xi} \tilde{\iota} \xi \tilde{\iota} \xi$ , tapering.)

\*Seales very small, 75-90 in the lateral line.

### 403. P. neogæus Cope.

Body short and thick, little compressed, the back little elevated. Head very large and broad, the muzzle blunt. Mouth moderate, quite oblique, the lower jaw projecting; maxillary reaching to beyond front of orbit; upper lip on the level of the middle of the pupil. Fins moderate. Dorsal well backward, much nearer caudal than snont, somewhat behind ventrals. Pectorals large. Scales very small, almost imbedded in the skin. Lateral line decurved, very short, not extending to ventrals. Back and belly scaly. Eye large, 3½ in head. Color very dark; back plain, almost black; a black band through snout and eye to caudal; above this a pale band; below this abruptly white; belly and lower fins crimson in spring males; pectorals dusky. Head 3½; depth 4½. D. 8; A. 8; scales 18–80–11; teeth 2, 4–5, 2. L. 3 inches. Michigan to Iowa; not common.

(Cope, Cypr. Penn. 1866, 375; Günther, vii, 247.)

#### 404. P. dammens Jordan & Gilbert.

Body moderately stout, slenderer and more compressed than in *P. neogœus*. Head rather short and deep, the upper outline rounded, the muzzle rather blunt. Eye large,  $3\frac{1}{3}$  in head. Month small, oblique, the Jaws about equal, the upper lip on the level of the pupil, the maxillary extending to the front of the orbit. Scales much larger and more loosely imbricated than in the other species. Back and belly scaled. Lateral line short, decurved, on 14 scales, not reaching base of ventrals. Fins small, the dorsal well backward. Back dark; a black lateral band, formed of dark specks; above this a pale band; the belly below this pale; bright scarlet red in the males in spring. Head 4; depth 4. D. 8; A. 8; scales 7-43-5; teeth 2, 4-5, 2. L. 24 inches. Tennessee River.

(Jordan & Gilbert, Man. Vert. E. U. S. ed. 2, 1878, 303; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 66.)

#### 405. P. milnerianus Cope.

"Form elongate, chin slightly beyond upper lip. Pharyngeal teeth 2, 5-4, 2. Scales in 15 longitudinal rows between the dorsal and ven-

<sup>\*\*</sup> Scales moderate, 40-45 in the lateral line.

tral fins. Diameter of orbit equal to length of muzzle, and entering length of head 33 times. The latter enters the length to origin of the candal fin 4 times. The greatest depth enters the same 5½ times. The dorsal fin originates above a point behind the entire base of the ven-Radii: D. I. 8; A. I. 8. The mouth is rather large, the extremity of the maxillary bone extending nearly to the line of the pupil of the eye. The head is rather flat above and wide, the parietal width being about one-third the length between the last dorsal ray and the base of the candal. The distance to which the lateral line extends is unknown. because the scales of the posterior part of the body are lost. brownish olive above, below silvery; a black band, not well defined on the borders, extends from the end of the muzzle to the base of the caudal fin, where it terminates in a black spot; a reddish spot at the base of the anterior dorsal rays; muzzle dark." (Cope.) L. 24 inches. Upper Missouri River. "This species differs from P. neogwus in its slender form and the small number of rows of scales."

(Cope, Amer. Nat. July, 1879, 440.)

\*\*\* Scales large, 35-40 in the lateral line.

## 406. P. phlegethontis (Cope) Jor. & Gilb.

Body short and deep. Mouth very oblique, the jaws even, the maxillary reaching front of the eye, which is rather large. Dorsal behind ventrals. Lateral line entirely wanting (in the typical examples; probably more or less developed in the adult, perhaps complete, in which case the species is a *Telestes*). Olivaceous; a broad plumbeous lateral band; a dusky dorsal line; belly golden. Head 4; depth 3½. D. 7; A. 8; scales 11–37; teeth 1, 5–4, 2. L. 1½ inches. Beaver River, Utah. (*Cope.*)

(Clinostomus phlegethontis Cope, Proc. Amer. Phil. Soc. Phila, 1874, 137: Gila phlegethontis Cope, Zoöl, Wheeler's Expl. W. 100th Mer. v, 657.)

#### 104.-LEUCUS Heckel.

## Roaches.

(Myloleucus Cope; ?Algansca Girard; not Leucus Kaup, 1824, a nominal genus of Larida, the word Leucus being a misprint for Leucus.)

(Leucos Heckel, Russeggers' Reisen, i, 1038, 1843: type Leucos cisalpinus Heckel.)

Body stout, compressed. Month normal, oblique; no barbel. Teeth 4-5\* or 5-5, hooked, with narrow grinding surface, the lower usually on

<sup>\*</sup> Teeth 4-4 in the type of Leucus tincella.

a prominent raised prominence of the bone. Scales moderate. Lateral line continuous, decurved. Anal basis short. Abdomen not compressed. Intestinal canal not elongate. Species numerous in Europe, Asia, and America. This genus is very closely allied to the European *Leuciscus* Cuvier, differing in the presence of teeth 5–5 or 5–4, instead of 6–5 or 6–6. The name finally to be adopted for this group, if admitted as distinct, is uncertain. ( $\lambda \epsilon o z o \epsilon$ , white.)

a. Teeth 4-1,\* with entire edges. (Algansca Girard.t)

#### 407. L. tincella (Val.) J. & G.

Body stoutish. Head heavy. Mouth moderate, oblique, the maxillary not reaching to the eye. Jaws about equal. Eye rather small. Candal peduncle thick. Fins small, the caudal short. Dorsal just over ventrals. Scales quite small, firmly attached and not closely imbricated, as in *Mylochilus*, etc. Coloration dark, plain; fins unspotted. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{5}$ ; scales 17-70-9; teeth 4-4. L. 6 inches. City of Mexico.

(Leuciscus tincella C. & V. xvii, 323; Günther, vii, 244.)

aa. Teeth 4-5, with entire edges. (Myloleucus Cope.;)

### 408. L. okesus (Grd.) Jor.

Body stout. Head short, the muzzle not decurved. Mouth small, oblique, terminal, the lower jaw somewhat projecting, maxillary nearly reaching to orbit. Eye  $4\frac{1}{5}$  in head; preorbital deeper than long. Color dark; the belly silvery; the scales everywhere dusted with black specks; a dusky lateral band. Head  $3\frac{3}{4}$ ; depth  $3\frac{1}{3}$ . D. 9; A. 8; scales 12-58-7 (13-58-9, Cope); teeth 5-4. L. 6 inches. Utah Basin; abundant.

(Algansca obesa Girard, Proc. Acad. Nat. Sci. Phila. 1856, 183, and U. S. Pac. R. R. Snrv. Fish. 239: Leuciscus obesus Giinther, vii, 244: Myloleucus pulverulentus Cope, Hayden's Geol. Surv. Mont. 1871, 475, 1872; Jordan & Henshaw, Rept. Chief Eng. 1878, App. NN. 192.)

#### 409. L. formosus (Grd.) Jor.

Very close to the next, and perhaps identical with it. Body a little more slender, the scales smaller, and profusely dotted with black as in *L. obesus*. Head 3<sup>3</sup><sub>4</sub>; depth 4. D. 8; A. 8; scales 10–53–6; teeth 5–4. L. 4 inches. California.

(Algansea formosa Girard, Proc. Acad. Nat. Sci. Phila. 1856, 183: Leuciseus formosus Günther, vii, 245; Jordan & Henshaw, l. c. 193.)

<sup>\*</sup> In specimens examined; the normal number is probably 5-4. If permanently 4-4, Algansea may be regarded as a distinct genus.

<sup>†</sup>Girard, Proc. Acad. Nat. Sci. Phila. 1856, 184: type Leuciscus tincella Val. (A coined name.)

<sup>‡</sup>Cope, Hayden's Geol. Surv. Mont. 1871, 475, 1872: type Myloleucus pulverulentus Cope = Algansea obesa Girard. (μύλος, grinder; λευκός, Lencus.)

### 410. L. bicolor (Grd.) Jor.

Body moderately stout. Head rather heavy, the muzzle very short and conical. Mouth moderate, very oblique, the jaws equal, the maxillary reaching line of eye. Scales rather large. Lateral line decurved. Eye rather large,  $4\frac{1}{2}$  in head. Color transparent, olivaceous; a distinct plumbeous lateral band. Fins dusky-shaded. Scales with some brown dots, but not profusely dusted with black specks as in the two preceding species. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ . D. 8; A. 7; scales 8–50–5 (11–48–5, Cope); teeth 4–5. Le 5 inches. Steams of Oregon, Nevada, etc.

(Algansea bicolor Girard, Proc. Acad. Nat. Sci. Phila. 1856, 183: Leuciscus bicolor Giinther, vii, 245: Myloleucus paroranus Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 669: Jordan & Henshaw, l. e. 193.)

### 411. L. anticus (Cope) Jor. & Gilb.

"Nearest to the formosus of Girard, but differs in the much more posterior position of the fins. In this the anterior base of the dorsal is equidistant between end of muzzle and base of tail; in anticus much behind the median point. The ventrals are much nearer the caudal than the chin; in the formosus the reverse is the case." Body moderate, shortened behind. Caudal peduncle short, thick. Caudal fin short, little forked. Mouth oblique, muzzle not reaching line of orbit. Eye 5 in head. Profile long, flat, descending; dorsal outline arched. Purplish slate above, yellow below; sides of head and edges of scales punctulate. Head  $3\frac{\pi}{8}$ . D. 8; A. 8; scales 10-50-6; teeth not described. L. 5 inches. Texas. (Cope.)

(Algansca antica Cope, Proc. Acad. Nat. Sci. Phila. 1864, 282.)

### 412. L. boucardi (Günther) Jor. & Gilb.

Body moderately elongate. Head thick, obtuse. Mouth broad, its cleft not extending to the eye. Snout convex, the lower jaw included. Eye moderate,  $4\frac{1}{2}$  in head. Caudal fin moderately forked. Origin of dorsal fin close behind that of the ventrals. Brownish; a bluish lateral band, forming a faint caudal spot. Head 4; depth 4. D. 8; A. 9; scales 6-39-4; teeth 5-4. L.  $3\frac{1}{2}$  inches. Cuernavaca, Mexico. (Günther.)

(Leuciscus boncardi Günther, vii, 485.)

### 105.-OPSOPŒODUS Hay.

(Hay, Proc. U. S. Nat. Mns. 1880, 507: type Opsopwodus emiliæ Hay.)

Form of *Hybognathus*. Mouth very small, almost vertical, its position entirely anterior, with scarcely any lateral eleft. Teeth 5–5, with grinding surface and serrated edges. Abdomen not compressed. Dorsal

nearly over ventrals. Anal basis short. Lateral line complete. Intestinal canal short. Peritoneum white. Small. (δψοποιέω, to feed daintily; δδους, tooth.)

## 413. O. emiliæ Hay.

Body rather elongate, moderately compressed, not elevated. Head short, slender. Muzzle blunt and rounded. Mouth very small and very oblique, smaller than in any other of our *Cyprinide*, with scarcely any lateral eleft; its size, when opened wide, less than that of the eye. Mandible short and deep, strongly curved, jaws equal. Eye longer than snout, 3 in head. Dorsal beginning over posterior rays of ventrals, nearer snont than base of caudal. Pectoral very small, not reaching ventrals, the latter to anal. Caudal peduncle long and slender. Anal short and deep. Breast naked; 16 large scales before dorsal. Yellowish; sides silvery; scales above dark-edged; a dark lateral band from snout to caudal, above and below which are series of black dots; anterior rays of dorsal dark; sometimes a black spot on the posterior rays. D. 9; A. 8; scales 5–40-3; teeth 5–5, scrrate. Eastern Mississippi.

(Hay, Proc. U. S. Nat. Mus. 1880, 507.)

### 106.—TRYCHERODON Forbes.

(Forbes, MSS, gen, nov.: type Trycherodon megalops Forbes.)

Pharyngeal teeth in one row, 5-5 or 5-6, strongly hooked, deeply erenate, without masticatory surface. Lateral line imperfect. Dorsal over ventrals. Intestine shorter than head and body. Peritoneum pale. Thorax naked almost to ventrals. Mouth terminal, upper jaw protractile. No barbels. (τροχεράτ, ragged; ὁδων, tooth.)

#### 414. T. megalops Forbes, spec. nov.

"A small, fusiform species, with a small, terminal, oblique mouth, a very large eye, an imperfect lateral line, a narrow black lateral stripe, a partly naked breast, and large fins. The dorsal has a large dusky black blotch on the front rays. The depth is contained from 4 to 5 times in the length without caudal; the head  $4\frac{1}{2}$  to 5 times. The eye is longer than the snout, and goes but  $2\frac{3}{4}$  times in the head. Its vertical diameter equals the interorbital space. The mandible scarcely reaches a vertical from the anterior border of the nostril, and falls far short of the orbit. The lateral line is variously imperfect; sometimes present only on the first 4 or 5 scales, and sometimes extending, with numerous interruptions, to the middle of the caudal peduncle. It

is slightly decurved when present on the anterior half of the body. The caudal fin is long and very deeply furgate. It is contained 31-4 times in head and body, and the median rays are about two-fifths the length of the longest. The dorsal is high, its longest ray reaching nearly or quite half the distance from front of dorsal to tail. The front of the fin is a little nearer nose than caudal. The pectorals extend about threefourths the distance to the ventrals, and the latter nearly or quite attain the vent. D. I, 7 or 8; A. I, 7 or 8; scales 5, 38-40, 4, with 15 or 16 rows before dorsal. The pharyngeal bones are thin, and suddenly and broadly dilated at outer third, this part of the bone being nearly 3 times as wide as the inner, and in shape not unlike a horse's jaw-bone. The odontoid process is unusually distinct and high. The teeth are very slender, strongly hooked, and sharply and irregularly crenate, the edges having a spinose appearance. The scales are crowded, higher than long, and wanting on the anterior half or two-thirds of the breast. Color in alcohol yellowish brown, with a faint silvery lustre on sides. A narrow, black band, about one scale wide, extends around the nose, through the upper half of the eye, to the tail, terminating there in the most highly colored specimens in a narrow vertical bar. The scales above the lateral band are all dark-edged. In all the specimens the dorsal shows a large submedian blotch in front, crossing about 4 rays. In one this blotch is so enlarged as to include the whole anterior half of the fin, except a small space at base, and a second blotch extends similarly across the 3 posterior rays, leaving only a narrow pale vertical stripe between. Length of largest specimen  $2\frac{1}{5}$  inches. Several specimens from the Illinois River at Pekin and Peoria, and from Mackinaw Creek." (Forbes.)

### 107.—NOTEMIGONUS Ratinesque.

Golden Shiners.

(Stilbe DeKay.)

(Rafinesque, Journ, de Physique, de Chymie et d'Histoire Naturelle, Paris, 1819, 421 : type Notemigonus auratus Raf. = Cyprinus chrysoleucus Mitch.)

Body subelliptical, strongly compressed, both back and belly curved, the curves different; back narrowly compressed; belly behind ventral fins forming a keel, over which the scales do not pass. Tail not keeled. Head small, conic. Mouth small, terminal, oblique, normal, without barbels. Scales rather large. Lateral line continuous, strongly decurved. Dorsal fin inserted behind the ventrals. Anal fin with its base somewhat elongate, of from 9 to 18 rays. Teeth 5-5, hooked, with

grinding surface, the edges of which are more or less crenate. Alimentary canal short, though rather longer than the body. Size rather large. As here understood, *Notemigonus* differs from the European Abramis (Bream) only in the much shorter anal fin—from 9 to 20 rays instead of 30 to 40. All its species are American. There is much variation in the length of the anal and in the form of the mouth among the species left in Abramis, and a reunion or a different division of the group may be necessary. ( $z\tilde{\omega}z\sigma_{5}$ , back;  $\dot{z}\omega$ , half;  $\dot{z}\omega\sigma_{5}$ , angle; the back being almost carinated.)

\* Insertion of dorsal midway of body or nearer snout than base of caudal. †Anal rays 9 or 10.

## 415. N. gardoneus (C. & V.) Jor.

Body moderately elongate, compressed. Head obtuse. Isthmus small. Month small, oblique, the lower jaw included. Eye 4 in head. Dorsal nearly midway of body, little behind ventrals. Olivaceons. Head  $5\frac{1}{2}$ ; depth  $3\frac{3}{4}$ . D. 10; A. 9; teeth 5–5, with grinding surface and serrated edge. Scales 7–39–3. South Carolina. One specimen known.

(Leneiscus gardoneus Cuv. & Val. xvii, 316: Chondrostoma gardoneum Cope, Trans. Amer. Phil. Soc. Phila. 1866, 395: Leneiscus gardoneus Günther, vii, 258.)

## 416. N. lucidus (Grd.) Jor.

Body rather elongate, subfusiform. Head moderate. Snout subconical, tapering. Mouth somewhat oblique, larger than in the other species, the maxillary reaching eye. Eye large,  $3\frac{1}{2}$  in head. Dorsal nearer tip of snout than caudal. Scales rather large, much deeper than long. Grayish above, yellowish beneath. Head  $4\frac{1}{4}$ . D. 8; A. 10. Canadian River. (Girard.)

(Luxilus lucidus Grd. Proc. Acad. Nat. Sci. Phila, 1856, 203, and U. S. Pac. R. R. Snrv. x, 282.)

# Anal rays about 13.

#### 417. N. leptosomus (Grd.) Jor.

Body rather elongate, slender, the back elevated. Head small and short, its profile continuous with that of the back. Mouth small, quite oblique, the maxillary not reaching the front of the large eye. Eye 3½ in head. Insertion of dorsal fin about midway between snont and base of caudal. Anal fin high and long. Bluish, silvery below. Head 5; depth 3¾. D. 9; A. 13; Lat. l. 55. Texas. (Girard.)

(Luxilus leptosomus Grd. Proc. Acad. Nat. Sci. Phila. 1856, 203, and U. S. Mex. Bound, Sury, 1chth. 60: Abramis? leptosomus Günther, vii, 306.)

<sup>\*\*</sup> Insertion of dorsal nearer base of candal than snout.

a. Anal rays about 11.

### 418. N. occidentalis (Baird & Girard) Jordan.

Body moderately elongate. Snout subconical, rather tapering. Mouth oblique, the maxillary not reaching orbit. Eye large, 4 in head. Brownish above; sides silvery; the belly speckled with gray. D. 10; A. 11. Tulare Valley, California. (Girard.)

(Leucosomus occidentalis Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 137: Luxilus occidentalis Girard, U. S. Pac. R. R. Surv. x, 280: Abramis occidentalis Günther, vii, 305.)

aa. Anal rays about 13 (12-14).

## 419. N. chrysolencus (Mitch.) Jor .- Golden Shiner; Bream.

Body moderately elongate, strongly compressed. Head short, subconic, compressed, the profile somewhat concave. Mouth small, oblique, the upper lip on the level of the upper part of the pupil, the maxillary not reaching the front of the eye. Eye moderate, about 4 in head. Fins medium. Color clear greenish above; sides silvery, with bright golden reflections; fins yellowish; the tips of the lower fins sometimes orange in spring males. Head  $4\frac{1}{2}$ ; depth 3. D. 8; A. 13; scales 10–51–3; teeth 5–5. L. 12 inches. New England to Dakota and Texas; everywhere abundant in bayous and weedy ponds. One of the most familiar and characteristic of our *Cyprinidæ*.

(Cyprinus chrysoleucus Mitch. Rept. Fish. N. Y. 1815, 23: Abramis rersicolor DeKay, N. Y. Fauna. Fish. 191: Leucosomus americanus Storer, Fish. Mass. 283: Stilbe americana Cope, Cypr. Penn. 1866, 389: Leuciscus, Leucosomus, Luxilus, Plargyrus, Stilbe, Stilbius, or Abramis americanus of various anthors (not Cyprinus americanus L.): Luxilus seco Girard, Proc. Acad. Nat. Sei. Phila. 1856, 203: Abramis americanus Günther, vii, 305; Jordan, Bull. U. S. Nat. Mus. x, 65.)

a. Anal rays about 16 (15-18).

### 420. N. americanus (L.) Jor.—Southern Bream.

Body moderately elevated, very strongly compressed. Head rather broad and flat between the eyes. Mouth small, quite oblique, the maxillary barely reaching the eye. Eye very large and prominent, anterior, about 3 in head. Dorsal fin short and very high, almost falcate, well back. Anal fin high and long. Scales rather large, the lateral line running very low. Color pale olive, with silvery lustre; lower fins red in the males in spring. Head  $4\frac{1}{3}$ ; depth  $3\frac{1}{3}$ . D. 8; A. 16; scales 8-43-2; teeth 5-5. L. 12 inches. Rivers of the South Atlantic States; locally abundant.

(Cyprinus americanus Linn. Syst. Nat.: Leuciscus bosci Cuv. & Val. xvii, 313: Notemigonus ischanus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 364; Jordan, Bull. U. S. Nat. Mus. x, 65.)

#### 108.—RICHARDSONIUS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila, 1856, 201; type Cyprinus balleatus Rich.)

Body oblong or elevated, strongly compressed. Head rather small. Mouth terminal, oblique, jaws normal; no barbels. Teeth 2, 5–5, 2, or 2, 5–4, 2, hooked, without grinding surface, the edges entire. Gillrakers very small. Belly compressed behind ventral fins, the scales passing over its edge. Back of tail not keeled. Scales rather small. Lateral line continuous, decurved. Dorsal fin well behind the ventrals. Anal basis elongate. American; closely related to the European genus Alburnus. (Dedicated to Sir John Richardson.)

## 421. R. balteatus (Rich.) Grd.

Body strongly compressed and somewhat elevated. Head small, the snout rather short and conical. Mouth terminal, oblique, the lower jaw slightly projecting beyond the upper. Eye large,  $3\frac{1}{2}$  in head. Coloration plain, the sides bright silvery, crimson in males in spring. Anal and candal large. Dorsal low, much behind ventrals. Base of anal  $4\frac{1}{4}$  in length. Head  $4\frac{1}{2}$ ; depth  $3\frac{1}{4}$ . D. 10; A. 17 or 18; Vert. 40; Lat. l. 13-62-6; teeth 2, 5-4, 2. Columbia River and northward; abundant.

(Cyprinus (Abramis) balteatus Richardson, Fauna Bor.-Amer. iii, 301: Richardsonius balteatus Grd. U. S. Pac. R. R. Surv. x, 278: Abramis balteatus Günther, vii, 309.)

#### 422. R. lateralis Grd.

Body slenderer and less compressed. Mouth moderate, terminal, oblique, jaws equal. Anal basis  $5\frac{1}{3}$  in length. Blackish above; a dark lateral band; the interspace and belly pale; crimson in males in summer. Head  $4\frac{1}{3}$ ; depth  $3\frac{3}{4}$ –4. D. 10; A. 14; scales 13–55–6; teeth 2, 5–5, 2. Columbia River and streams about Puget Sound.

(Richardsonius lateralis Grd. Proc. Acad. Nat. Sci. Phila, 4856, 202, and U. S. Pac. R. R. Surv. Fish, 279; Abramis lateralis Günther, vii, 309.)

#### 109.—LEPIDOMEDA Cope.

(Cope, Proc. Amer. Phil. Soc. Phila, 1874, 131; type Lepidomeda vittata Cope.)

Body elongate. Mouth terminal, without barbels. Teeth 2, 4–4, 2, hooked, without grinding surface. Scales small. Lateral line complete. Dorsal fin with a strong spine, composed of two, the posterior received into a longitudinal groove of the anterior. Inner border of the ventral fins adherent to the body. Dorsal fin inserted behind the ventrals. Anal basis short. Size small. ( $\lambda \xi \pi \iota \delta \sigma \tau_{\tau}$ , scaly; Meda.)

#### 423. L. vittata Cope.

Body rather stout. Head wide and flat above, slightly depressed behind the eyes. Muzzle obtuse, not prominent. Mouth terminal, oblique. Eye 3\frac{3}{4} in head. Scales small, covering the whole body except the space behind the pectorals; 26 series above the lateral line and 56 in front of the dorsal. Preorbital bone trepezoidal. Second dorsal spine as long as the first, and wider. Dorsal rays somewhat enlarged and ossified. Pectoral rays scarcely enlarged. Color silvery; a lead-colored lateral band and a black dorsal band. Head 3\frac{3}{4}; depth 4\frac{1}{4}. D. II, 7; A. 9; teeth 2, 4-4, 2. L. 3\frac{1}{2} inches. Colorado Chiquito River, Arizona. (Cope.)

(Cope, Proc. Amer. Phil. Soc. Phila, 1874, 131, and Zoöl, Wheeler's Expl. W. 100th Mer. v, 642.)

#### 424. L. jarrovii Cope.

Body more elongate. Month nearly horizontal, lower jaw somewhat projecting. Eye larger than in *L. vittata*,  $3\frac{1}{4}$  in head, the maxillary reaching its anterior border. Spines slender. Scales very small and difficult to detect, 51 series before the dorsal fin. Olivaceous; a median black vertebral band; sides silvery; bases of ventral fins red. Head 4; depth 5. D. II, 7; A. 9; teeth 2, 4–4, 2. L. 3 inches. Colorado Chiquito River, Arizona. (*Cope.*)

(Cope, Proc. Acad. Nat. Sci. Phila. 1874, 133, and Zoöl. Wheeler's Expl. W. 100th Mer. v, 643.)

#### 110.—MEDA Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 191: type Meda fulgida Grd.)

Body elongate. Mouth terminal, normal, no barbels. Teeth 1,4–4, 1, hooked, without grinding surface. Body entirely scaleless. Fins as in *Lepidomeda*. Size small. (*Meda*, a classical feminine name, of no conceivable application to these singular fishes.)

#### 425. M. fulgida Grd.

Body slender, elongate, compressed. Head elongate, subconical, the snout rounded. Mouth large, subterminal, slightly oblique, the lower jaw included, maxillary extending to below orbit. Second dorsal spine highest; dorsal behind ventrals. Coloration silvery. D. II, 7; A. 8; teeth 1, 4–4, 1. Rio Gila. (Girard.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 191; Günther, vii, 263.)

#### 111.-PLAGOPTERUS Cope.

(Cope, Proc. Amer. Phil. Soc. Phila. 1873, 301: type Plagopterus argentissimus Cope.) Body slender. Mouth terminal, a barbel at the extremity of the maxillary. Teeth 2, 5–4, 2, hooked, without grinding surface. Body entirely scaleless. Fins as in Meda and Lepidomeda. Size small.  $(\pi \lambda a \gamma i,$  wound;  $\pi \tau z \rho \partial z$ , fin; in allusion to the armature of the dorsal fin.)

## 426. P. argentissimus Cope.

Body slender. Head rather broad, the muzzle slightly depressed, overhanging the rather small, horizontal mouth. Lips thin, the maxillary reaching front of eye. Eye moderate,  $4\frac{1}{5}$  in head. Dorsal fin entirely behind ventrals, the first spine curved, longer than the second; soft rays of the dorsal thickened and ossified at base; fifth ray of the ventral bound to the abdomen by a membrane for nearly its whole length; pectoral rays osseous at base. Lateral line complete, slightly deflexed. Color clear silvery; dorsal region dusky, with minute black dots. Head 4; depth 6. D. H, 7; A. 10; teeth 2, 5-4, 2. L.  $2\frac{1}{2}$  inches. San Luis Valley. Western Colorado. (Cope.)

(Cope, Proc. Amer. Phil. Soc. Phila, 1874, 130, and Zoöl, Wheeler's Expl. W. 100th Mer. v, 640.)

#### 112.—CARASSIUS Nilsson.

### Crucian Carps.

(Nilsson, Prodromus: type Cyprinus carassius L. = Carassius rulgaris Nilss.)

Body oblong, compressed, and elevated. Mouth terminal, without barbels. Teeth 4–4, molar, but compressed. Scales large. Lateral line continuous. Dorsal fin very long, with the third ray a stout spine, which is serrated behind; anal short, with a similar spine. Ventrals well forward. Large species of the fresh waters of Europe and Asia; often domesticated. (*Carassius*, a latinization of the vernacular names of the European Crucian Carp, *Karass* or *Karausche*.)

### 427. C. auratus (L.) Blecker.-Gold-fish.

Body stout, covered with large scales. Dorsal and anal fins with the spines strong, coarsely serrated. Coloration olivaceous, usually orange or variegated in domestication. D. H, 18; A. H, 7; Lat. I. 26; teeth 4–4. L. 12 inches. China and Japan; introduced everywhere as an aquarium fish, and now naturalized in many of our eastern streams. The variations are innumerable.

(Cyprinus auratus Linnaus, Syst. Nat.; Günther, vii, 32.)

#### 113.—CVPRINUS Linnæus.

### Carps.

(Artedi; Linnæus, Syst. Nat.: type Cyprinus carpio L.)

Body robust, compressed, resembling that of the Buffalo-fish. Mouth moderate, anterior, with four long barbels. Snout blunt, rounded. Teeth molar, broad and truncate, 1, 1, 3–3, 1, 1. Scales large. Lateral line continuous. Dorsal fin very long, with a stout spine, serrated behind; anal fin short, also with a spine. Large fishes of the fresh waters of Asia: introduced into Europe and America as food-fishes. (χυπρίνος, the ancient name of the Carp.)

## **428.** C. carpio L.—Carp.

Body stout, more or less compressed, heavy anteriorly. General color olivaceous. D. III, 20; A. III, 5; scales 5-38-5; teeth 1, 1, 3-3, 1, 1. L. 18 inches or more. Fresh waters of Central Asia; introduced as a food-fish into Europe and America. In domestication it has run into many varieties, distinguished by differences in form, squamation, and development of the fins.

(Linnaus, Syst. Nat.; Günther, vii, 25.)

## FAMILY XXXII.—CHARACINIDÆ.

## (The Characins.)

Body variously formed, covered with cycloid scales. Head naked. Margin of upper jaw formed mesially by the premaxillaries and laterally by the maxillaries; no barbels; premaxillaries not protractile. Teeth various, often incisor-like, often wanting. Branchiostegals usually 3. Gill-membranes united to the isthmus or not. No pseudobranchiae. Gills 4, a slit behind the fourth. Lower pharyngeals not truly falciform, but more or less curved, armed with small, sometimes villiform, teeth. Adipose fin usually present (absent in *Erythriniae*). Pyloric ecca usually numerous. Air-bladder transversely divided into two portions, and communicating with the organ of hearing by means of auditory ossicles, as in the *Cyprinide*. Anterior vertebræ coalesced and modified. A very large family of 60 genera and 300 species, inhabiting the fresh waters of South America and Africa, where they take

the place of the Salmonida and Cyprinida of the Northern Hemisphere. A single species reaches the United States.

(Characinida Giinther, vii, 278-380.)

- \* Adipose fin present.
  - †Dentition complete in both jaws; gill-openings wide, the membranes not attached to the isthmus; nasal openings of each side close together; teeth compressed, notched. (Tetragonoptering.)
    - ‡ Anal fin clongate (rays 20-50); belly in front of ventrals rounded: premaxillary teeth in a double series; a single series of teeth in lower jaw, with no conical teeth belind it; no canine teeth; gill-rakers setiform.. Tetragonopterus, 114.

#### 114.—TETRAGONOPTERUS Cuvier.

(Astyanax B. & G.; Pacilurichthys Gill.)

(Artedi; Cuvier, Mém. dn Mus. iv, 455, 1818: type Tetragonopterus argenteus Cuv.)

Body oblong or elevated, compressed, covered with moderate scales. Belly rounded. Cleft of mouth medium. Anterior teeth strong, incisor-like; lateral teeth small. Premaxillary and mandibular teeth subequal in size, with a compressed, notched crown, the former in a double, the latter in a single, series. Maxillary with few teeth. Nostrils of each side close together, separated by a valve only. Lower pharyngeals very slender, curved, approaching the form in Cyprinidæ, armed with a single series of slender, hooked teeth. Gill-openings wide, the membranes free from the isthmus and from each other. Gill-rakers setiform. Dorsal fin midway of body, above or just behind ventrals. Anal fin long. Species about 40, in all the warmer parts of America. (τετράγωνος, four-angled; πτερόν, fin or wing; of no special application to this group, the original word used by Klein and Artedi being Tetragonoptrus.)

**a.** Body oblong, moderately elevated, the depth less than half-length. ( <code>.1styanax</code> Baird & Girard. \*)

### 429. T. argentatus (Baird & Girard) J. & G.

Olivaceous; a broad silvery band along sides; a black spot at base of caudal, running up on the fin. Body oblong, compressed. Snout blunt, lower jaw included. Dorsal inserted above ventrals. Pectorals reaching ventrals, the latter to vent. Head 4 in length; depth 3. D. 10; A. 21; scales 6–38–6. Arkansas to Mexico; probably abundant; the northernmost representative of the family.

(Astyanax argentatus B. & G. Proc. Acad. Nat. Sci. Phila. vii, 27, 1854; Astyanax argentatus Grd. U. S. Mex. Bound. Surv. Ichth. 74; Günther, v. 380.)

<sup>\*</sup>Baird & Girard, Proc. Acad. Nat. Sei. Phila. vii, 26, 1854: type Astyanax argentatus B. & G. (αστυάναξ, a son of Hector.)

# ORDER M.—ISOSPONDYLI.

(The Isospondylous Fishes.)

Parietals present. Symplectic present. No interclavicles. A præcoracoid arch. Auterior vertebræ simple. No auditory ossieles. Pharyngeal bones simple above and below, the lower not falciform. Gills 4, a slit behind the fourth. A very large group, presenting many modifications of structure.  $(i\sigma\sigma_5, \text{equal}; \sigma\pi\acute{\sigma}\nu\acute{\sigma}\nu\acute{\sigma}\nu\acute{\sigma}\nu$ , vertebra.)

(Physostomi Günther, part.)

ANALYSIS OF FAMILIES OF ISOSPONDYLL.

\* Tail diphycercal.

- a. Lateral margins of upper jaw formed by the maxillaries.
  - b. Adipose fin none; no phosphorescent spots; body usually scaly; head naked; throat without barbel.
    - c. Lateral line present.
      - d. Gular plate none.
        - e. Air-bladder none; dorsal posterior, opposite anal and similar to it; month small, with small, pointed teeth; deep-sea fishes.

ALEPOCEPHALIDE, 33.

ee. Air-bladder present; dorsal in front of anal.

- f. Mouth small, horizontal; posterior part of tongue and the roof of the mouth covered with coarse, paved teeth... Albulider, 34.
- ff. Month larger, oblique; teeth all pointed; those on the tongue large.

  Hyddontide, 35.
- dd. Gular plate present; mouth large; teeth all pointed . . . . . Elopidæ, 36, cc. Lateral line obsolete.
  - g. Mouth terminal, large; maxillary in three parts, mostly broad.

CLUPEIDÆ, 37.

- bb. Adipose fin present (rarely absent, and the body with phosphorescent spots).

  - hh. Throat without barbel.
    - Sides with phosphorescent spots; oviduets present; deep-sea fishes.
      - j. Pseudobranchiae none; body scaly ..... Chauliodontide, 44.
      - jj. Pseudobranchiæ present; body naked. Sternoptychide, 43.
    - ii. Sides without phosphorescent spots; oviducts none.

Salmonidee, 46.

- aa. Lateral margius of upper jaw, like the anterior margin, formed by the premaxillaries; adipose fin usually present.
  - k. Premaxillaries short, with villiform teeth; mouth small; bones of head cavernous; scales etenoid. Percopside, 47.
  - kk. Premaxillaries elongate; mouth large; bones of head not cavernous; scales mostly cycloid.
    - 1. Dorsal short, nearly median; body scaly. Scopelide, 42.
    - ll. Dorsal short, posterior: body scaly.. Paralepidide, 41.

# FAMILY XXXIII.—ALEPOCEPHALIDÆ.

Body oblong, compressed, covered with thin cycloid or keeled scales, or with naked, prickly skin. Head naked. Lateral line developed. No barbels. Mouth moderate or large. Margin of the upper jaw formed by the premaxillaries and the maxillaries, the former being placed along the upper anterior edge of the latter. Teeth feeble. Opercular apparatus complete, its bones thin. No adipose fin. Dorsal fin long and low, posterior, inserted opposite the anal; pectorals short, placed rather high; ventrals usually well back, sometimes wanting. Gill-openings very wide, the membranes free from the isthmus. Pseudobranchiæ present. No gular plate. No air-bladder. Stomach curved, without blind sac. Pyloric cœca in moderate number. Fishes of the deep seas; but one species known until recently. Lately 3 genera and 7 species have been described from the abyssal faunæ of the mid Atlantic and Pacific.

(Alepocephalida Günther, vii, 477.)

a. Scales cycloid; dorsal and anal subequal, opposite each other; mouth small; jaws nearly even; small teeth in jaws, vomer, and palatines. Alepocephalus, 115.

#### 115.-ALEPOCEPHALUS Risso.

(Risso, Mem. Acad. Nat. Sci. Turin, xxv, 270, 1820: type Alepocephalus rostratus Risso, from the Mediterranean.)

Body oblong, compressed. Month rather small, the snout somewhat prolonged. Jaws nearly equal in front; a series of small teeth in each jaw and on the vomer and palatines. Eye very large. Gill-membranes entirely separate. Branchiostegals 6. Opercular bones thin. Dorsal low and rather long, with a scaly base, opposite and similar to the anal. Pectorals and ventrals rather small. Caudal moderately forked. Scales rather large, thin and cycloid. Deep-sea fishes of the Atlantic and Mediterranean. (a, privative;  $\lambda \varepsilon \pi i \tau$ , scale;  $z \varepsilon \varphi a \lambda \tau$ , head.)

#### 430. A. bairdii Goode & Bean.

Uniform indigo-blue, the color extending to the inside of the mouth and the gill-membranes. Body rather elongate. Head moderately compressed, subconical, the lower jaw included. Maxillary extending nearly to below middle of eye. Eye large, as long as snout. Dorsal slightly in advance of anal. Head 4½ in length; depth 5½. D. 22; A. 25; P. 12; V. I, 9; pyloric ecca 15; B. 6; scales 7-65-11. L. 24 inches. Grand Banks; dredged at a depth of 200 fathoms. (Goode & Bean.)

(Goode & Bean, Proc. U. S. Nat. Mns. ii, 55, 1879.)

Bull. Nat. Mus. No. 16——17

# FAMILY XXXIV.—ALBULIDÆ.

(The Lady-fishes.)

Body rather elongate, little compressed, covered with rather small. brilliantly silvery scales. Head naked. Snout conic, subquadrangular, shaped like the snout of a pig, and overlapping the small, inferior, horizontal mouth. Maxillary rather strong, short, with a distinct supplemental bone, slipping under the membranous edge of the very broad preorbital. Premaxillaries short, not protractile. Lateral margin of upper jaw formed by the maxillaries. Eve large, median in head, with a bony ridge above it, and almost covered by an annular adipose eve-Opercle moderate, firm. Preopercle with a broad, flat, membranaceous edge, which extends backward over the base of the opercle. Pseudobranchiæ present. Gill-rakers short, tubercle-like. Gill-membranes entirely separate, free from isthmus. Branchiostegals about A fold of skin across gill-membranes anteriorly, its posterior free edge crenate. No gular plate. Both jaws, vomer, and palatines with bands of villiform teeth. Broad patches of coarse, blunt, paved teeth on the tongue behind and on the sphenoid and pterygoid bones. Lateral line present. Belly not carinate, flattish, covered with ordinary scales. Dorsal fin moderate, in front of ventrals, its membranes scaly, No adipose fin. Anal very small. Caudal widely forked. Pyloric cœca numerous. A single species known, found in all warm seas.

(Clupcida group Albulina Günther, vii, 468, 469.)

#### 116 .- ALBULA Gronovius.

(Gronovins; Bloch & Schneider, Syst. Ichth. 1801, 432: type Albula conorhynchus Bloch & Schneider = Esox vulpes L.)

Characters of the genus included above. (Latin albus, white.)

#### 431. A. vulpes (L.) Goode.—Lady-fish; Bone-fish.

Brilliantly silvery; olivaceous above; back and sides with faint streaks along the rows of seales; fins plain; axils dusky. Upper lobe of caudal the longer. A band of peculiar, elongate, membranaceous seales along middle line of back; accessory ventral scale large. Head  $3\frac{3}{4}$ ; depth 4. D. 15; A. 8; scales 9-71-7. L. 18 inches. Cape Cod to Southern California and East Indies; abundant in tropical seas. Not much valued as food, but beautiful and gamy.

(Esox rulpes L. Syst. Nat.: Albula conorhynchus Günther, vii, 468.)

## FAMILY XXXV.—HYODONTIDÆ.

(The Moon Eues)

Body oblong, compressed, covered with moderate-sized, brilliantly silvery, eyeloid scales. Head naked, short, the snout blunt. Mouth moderate, oblique, terminal, the jaws about equal. Premaxillaries not Maxillary small, slender, without evident supplemental bone, articulated to the end of the premaxillary, and forming the lateral margin of the upper jaw. Dentition very complete. Premaxillary and dentary bones with small, wide-set, cardiform teeth. Maxillaries with feeble teeth. A row of strong teeth around the margin of the tongue, the anterior eanine and very strong; between these is a band of short, close-set teeth. Vomer with a long, double series of closeset, small teeth. Similar series on the palatines, sphenoid, and ptervgoids. Sides of lower jaw fitting within the upper, so that the dentaries shut against the palatines. Eye very large, the adipose eyelid not much developed. Preorbitals very narrow. Nostrils large, those of each side close together, separated by a flap. Gill-membranes not connected, free from the isthmus, a fold of skin covering their base. No gular plate. Branchiostegals 8-10. Gill-rakers few, short and thick. Pseudobranchiæ obsolete. Lateral line distinct, straight. Belly not serrated. Dorsal fin rather posterior. Anal elongate, low. Ventrals well developed. Candal strongly forked. No adipose fin. Stomach horseshoe-shaped, without blind sac; one pyloric cocum. Air-bladder large. No oviducts, the eggs falling into the cavity of the abdomen before exclusion. A single genus, with 3 known species, inhabiting the fresh waters of North America.

(Hyodontidæ Günther, vii, 375, 376.)

#### 117.-HYODON Le Sueur.

Moon Eyes.

(*Hiodon* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 354, 1818: type *Hiodon tergisus* Le Sueur.)

Generic characters included above. (bostonics, hyoid;  $\delta\delta\omega\nu$ , tooth; "hyoid" is the bone shaped like the letter  $\Gamma$ , forming the base of the tongue.)

\* Belly in front of ventrals strongly carinated; dorsal rays (developed) 9.

## 432. II. alosoides (Raf.) J. & G.

Body closely compressed, becoming deep in the adult. Eye moderate, smaller than in other species, about 3½ in head, the maxillary

reaching to beyond its middle. Caudal peduncle rather stouter than in H. tergisus, and the fin not so deeply forked. Back less arched and snout blunter than in the other species, the mouth larger and more oblique. Pectorals longer and ventrals shorter than in H. tergisus, Belly carinated both before and behind ventrals. Bluish; sides silvery. with golden lustre. Head  $4\frac{1}{2}$ ; depth  $3\frac{1}{2}$ . D. 9; A. 32; scales 6-56-7. Ohio River to the Saskatchawan; common northward.

(Amphiodon alosoides Raf. Journ. Phys. Paris, 1819, 421: Hyodon chrysopsis Richardson, Fauna Bor.-Amer. iii, 232, 1836: Hyodon chrysopsis Jordan, Bull. U. S. Nat. Mus. x, 68, 1877: Hyodon amphiodon Raf. Ichth. Oh. 1820, 42.)

\*Belly in front of ventrals not carinated; dorsal fin with 11 or 12 developed rays.

†Belly behind ventrals carinated.

### 433. II. tergisus Le Sueur.-Moon Eue: Toothed Herring.

Body oblong, moderately compressed. Eye large, 3 in head, the maxillary barely reaching its middle. Pectoral fins not reaching ventrals, the latter just short of vent. Belly behind ventrals somewhat carinate. Color silvery, olive-shaded above. Head  $4\frac{1}{3}$ ; depth 3. D. 12; A. 28; scales 5-55-7. L. 12 inches. Great Lakes and Mississippi Valley; abundant in our larger streams. One of our handsomest fishes; not valued as food.

(Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 364, 1818: *Hiodon clodalus* Le Sueur, l. c. 367: *Cyprinus* (*Abramis?*) *smithi* Rich. Fauna Bor.-Amer. iii, 110; Günther, vii, 375; Jordan, Bull. U. S. Nat. Mus. x, 68, 1877.)

#Belly nowhere carinated.

#### 134. H. selenops Jordan & Bean.

Body more elongate, little compressed, not elevated. Belly nowhere carinate. Eye very large,  $2\frac{1}{2}$  in head. Pectorals not reaching nearly to ventrals. Clear silvery. Head  $4\frac{1}{8}$ ; depth 4. D. 12; A. 27; Lat. l. 50. Cumberland River and southward.

(Jordan & Bean, Bull. U. S. Nat. Mus. x, 68, 1877.)

# FAMILY XXXVI.—ELOPIDÆ.

## (The Big-eyed Herrings.)

Body elongate, not much compressed, covered with eyeloid scales. Head naked. Mouth broad, terminal, the lower jaw prominent. Premaxillaries not protractile, short, the maxillaries forming the lateral margins of the upper jaw. Maxillary composed of about three pieces, extending backward beyond the eye. An elongate bony plate between the branches of the lower jaw (like the gular plate in Amia). Bands

of villiform teeth in both jaws and on vomer, palatines, pterygoids, tongue, and base of skull. No large teeth. Eye large, with an adipose eyelid. Gill-membranes entirely separate, free from the isthmus. Branchiostegals numerous (20-35). Gill-rakers long and slender. Pseudobranchiæ present or absent. Belly not keeled nor serrated, covered with ordinary seales. Lateral line present. Dorsal fin over or rather behind ventrals. Caudal fin forked. No adipose fin. Pyloric cœca numerous. Two genera, not much alike, with 4 or 5 species, widely distributed, sometimes entering fresh waters.

(Clupcida group Elopina Günther, vii, 469-472.)

#### 118.-ELOPS Linnaus.

## Big-eyed Herrings.

(Linnaus, Syst. Nat: type Elops saurus L.)

Body elongate, covered with thin, small, silvery scales. Dorsal fin slightly behind ventrals, its last rays short, the fin depressible into a sheath of scales. Anal fin smaller, similarly depressible. Pectorals and ventrals moderate, each with a long accessory scale. Opercular bones thin, with expanded, membranaceous borders; a scaly occipital sheath or collar. Lateral line straight, its tubes simple. Pseudobranchiæ present, large. Species 2 or more, widely distributed, remarkable for the development of scaly sheaths. (ἔλοψ, name of some sea-fish—a sword-fish or sturgeon; from ἐλάω, to drive or move.)

#### 435, E. saurus L.—Big-eyed Herring.

Uniform silvery, darker above. Gular plate 3-4 times as broad as long. Head 4¼; depth 5-6. Eye large, 4-5 in head. D. 20; A. 13; V. 15; B. 30; scales 12-120-13. L. 24 inches. Cape Cod to Cape of Good Hope and China. A handsome fish, not rare on our Atlantic coast.

(Linn. Syst. Nat.; Günther, vii, 470.)

#### 119.—MEGALOPS Lacépède.

## Tarpums.

(Commerson; Lacépède, Hist. Nat. des Poissons, v. 289, 1803: type Megalops filamentosus Lac. = Clupea cyprinoides Broussonet.)

Body oblong, compressed. Head large, compressed. Eye very large. Belly narrow, covered with ordinary scales. Month large, oblique.

Maxillary broad, extending beyond the eye. Villiform teeth on jaws, vomer, palatines, tongue, sphenoid, and pterygoid bones. Scales large, firm. Lateral line nearly straight, its tubes radiating widely in each of its scales. Dorsal fin short and high, over or behind ventrals; last ray of dorsal elongate, filamentous, as in Dorosoma and Opisthonema. Anal fin long, falcate, its last ray produced, its base much longer than that of the dorsal. Caudal fin widely forked. Pectorals and ventrals rather long. Gill-rakers long. Anal fin with a sheath of scales; dorsal fin naked; caudal fin largely scaly; nape with a collar of large scales. Pseudobranchiæ none. Species of very large size, largest of the Clupcoid fishes, found in all warm seas.  $(n\ell\gamma a\lambda o\psi, large-eyed.)$ 

\*Origin of dorsal behind the ventrals.

## 436. M. thrissoides (Bloch & Schneider) Günther. - Tarpum; Jew-fish.

Uniform brilliant silvery, back darker. Body elongate, compressed, little elevated. Head 4 in length; depth  $3\frac{4}{5}$ . D. 12; A. 20; Lat. l. 42; B. 23. Dorsal filament longer than head. Atlantic Ocean, entering fresh water; common on our southern coasts, and noted for the great size of its scales, which are used in ornamental work.

(Clupea thrissoides Bloch & Schneider, 1801, 424; Günther, vii, 472.)

# FAMILY XXXVII—CLUPEIDÆ.

(The Herrings.)

Body oblong or elongate, more or less compressed, covered with cycloid or pectinated scales. Head naked, usually compressed. Mouth rather large, terminal, the jaws about equal. Maxillaries forming the lateral margins of the upper jaw, each composed of about three pieces. Premaxillaries not protractile. Teeth mostly feeble or wanting, variously Gill-rakers long and slender. Gill-membranes not connected, free from the isthmus. No gular plate. Gills 4, a slit behind the Branchiostegals usually rather few (6-15). Posterior lower part of opercular region usually with an angular emargination, the tips of the larger branchiostegals being abruptly truncate. Pseudobranchiæ present. No lateral line (at least in our species). Dorsal fin median or somewhat posterior. No adipose fin. Ventrals moderate or small (wanting in Pristigaster). Anal usually rather long. Caudal fin forked. Belly sometimes rounded, sometimes compressed and armed with bony serratures. Genera 15; species 130; inhabiting all seas, and usually swimming in immense schools. Many species ascend fresh waters, and some

remain there permanently. The current genera are ill defined and apparently too numerous, and we have followed Dr. Günther in referring most of them to *Clupea*. The rudimentary teeth are extremely variable, even in the same species.

(Cluscida groups Clupcina and Dussumieriina Günther, vii, 412-467.)

- \* Belly rounded, covered with ordinary scales; supplemental bones of maxillary very narrow. (Dussumieriing.)
- \*\* Belly compressed, armed with bony serræ; supplemental bones of maxillary broad. (Clupcina.)
  - b. Scales with their posterior margins entire and rounded.
    - c. Last ray of dorsal not produced.
  - cc. Last ray of dorsal produced in a long filament.........OPISTHONEMA, 124. bb. Scales with their posterior margins vertical, and pectinate or fluted.

Brevoortia, 125,

#### 120.-ETRUMEUS Bleeker.

## Round Herrings.

(Bleeker, Verh. Bat. Gen. xxv, Japan, 48: type Clupea micropus Schlegel, from Japan.)
Body elongate, fusiform, subcylindrical, snout pointed. Mouth terminal, rather wide, the maxillary extending to opposite the eye, its supplemental pieces slender; jaws and most of the bones of the mouth with small but permanent teeth. Scales cycloid, entire, very deciduous. Branchiostegals fine, about 15 in number. Pyloric cœca numerous. Belly rounded, covered with ordinary scales. Fins all small, the anal especially so. Ventrals behind dorsal. Two species known. (Ετρων, abdomen; δμός, even?)

#### 437. E. teres (DeKay) Günther.-Round Herring.

Olivaceous above, silvery on sides and below. Body terete and fusiform. Head slightly compressed forwards. Mouth small, maxillary reaching front of orbit. Eye large, equal to snout. Fins all very small. Vomerine teeth present. Head 4 in length; depth 6. D. 13; A. 10. Atlantic coast of the United States; not common.

(Alosa teres DeKay, New York Fauna, Fish. 1842, 262; Günther, vi. 467.)

#### 121.—SPRATELLOIDES Blecker.

(Blecker, Verh. Bat. Gen. xxiv, Haring, 29: type Clupea argyrotania Blecker.)

Body elongate, subcylindrical or slightly compressed, covered with moderate-sized deciduous scales. Abdomen obtuse, without keel or serrature. Mouth essentially as in *Clupea*. Teeth none, or minute and deciduous. Gill-membranes separate, with about 6 flat branchiostegals. Pseudobranchiæ well developed. Dorsal opposite ventrals; anal fin short. Stomach with long, blind sac; pyloric cœca in moderate number. Pacific and Indian Oceans. (*Spratellus*, sprat; \$\ilde{\cappa}\lambda \sigma\_5\$, resemblance.)

## 438. S. bryoporus Cope.

Form compressed, moderately elongate. Belly rounded, except between ventral fins and vent, where it is angular. Maxillary broad, flat, reaching to opposite middle of pupil. Ventrals a little in front of middle of dorsal. Lower fins short. Pectorals  $2\frac{1}{2}$  in distance to ventrals. Golden; bluish above. Top of head with a bifurcate depression, filled with delicate, branching mucous tubules; opercular and postfrontal regions with similar tubes. Head 5; depth  $4\frac{1}{2}$ . D. 18; A. 18; scales 51–12. L. 14 inches. Coast of Alaska. (Cope.)

(Cope, Proc. Amer. Phil, Soc. Phila, 1873.)

#### 122.—CLUPEA Linnæus.

## Herrings.

(Clupea, Alosa, Pomolobus, Meletta, Spratella, etc., of authors.) (Linneus, Syst. Nat.: type Clupea harengus L.)

Body oblong, more or less compressed. Mouth moderate, terminal, the jaws about equal, or the lower projecting. Teeth feeble, variously placed, rarely absent. Mandibles very deep at base, shutting within the maxillaries. Gill-rakers more or less long and slender, numerous. Scales thin, cycloid, decidnous, entire, rounded posteriorly. Dorsal fin rather short, nearly median, beginning in advance of ventrals, its posterior ray not prolonged in a filament. Ventrals present. Anal moderate. Belly compressed, more or less strongly serrated, at least behind ventrals. Species very numerous; found in all seas. (Latin clupea, a herring.)

Our species may be divided as follows:

\* Vomer with an ovate patch of teeth; ventral serratures weak; herrings (Clupea).

\*harengus, mirabilis.

\*\* Vomerine teeth none.

†Cheeks longer than deep, the preopercle produced forward below. (POMOLOBUS Raf.)

a. Ventral serratures weak sagar.

aa. Ventral serratures strong.

bb. Jaws without persistent teeth (MELETTA Val.).

 \*Vomer with an ovate patch of teeth; ventral serratures weak; herrings. (Clupca.)

# 439. C. harengus L.—Common Herring; "Whitebait" (young).

Bluish; silvery below, with bright reflections. Body elongate, compressed. Scales loose. Cheeks longer than high, the junction of the mandible and preopercle under middle of eye. Maxillary extending to middle of eye. Upper jaw not emarginate. Lower jaw much projecting. Gill-rakers very long, fine and slender, about 40 on the lower part of the arch. Eye longer than snout, 4 in head. Dorsal inserted rather behind middle of body, in front of ventrals. Pectorals and ventrals short; anal low. Abdomen serrated in front of ventrals as well as behind. Peritoneum dusky. Head  $4\frac{1}{2}$ ; depth  $4\frac{1}{2}$ . D. 18; A. 17; Lat. l. 57; ventral scutes 28+13; vertebræ 56. Atlantic Ocean; abundant on the coasts both of Europe and America. Spawns in the sea.

(Linn. Syst. Nat.; Günther, vii, 415: Clupea elongata Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 234.)

## 410. C. mirabilis Girard.—California Herring.

Bluish above; sides and below silvery; peritoneum dusky. Lower jaw strongly projecting; upper jaw not emarginate. Belly scarcely compressed in front of ventrals, serrate only between ventrals and anal. Gill-rakers very long and slender. Vomerine teeth weaker than in C, harengus; usually a few teeth on tongue and premaxillary. Vertebræ also fewer, 30 + 20 = 50. Insertion of dorsal slightly nearer front of eye than base of caudal. Head  $4\frac{1}{3}$ ; depth 4. D. 16; A. 14; Lat. 1. 52. Pacific coast of North America. Very similar to C, harengus, and equally abundant.

(Girard, Proc. Acad. Nat. Sci. Phila, 1854, 138; Günther, vii, 418.)

†Cheeks longer than deep, the preopercle produced forward below. (Pomolobus Rafinesque.\*)

a. Ventral serratures weak; mouth entirely toothless.

#### 441. C. sagax Jenyns .- California Sardine; Sadina.

Dark bluish above; silvery below; a series of round black spots on the level of the eye, running backward, bounding the dark color of the back; similar smaller spots above, forming lines along the rows of scales; these spots rarely obscure or wanting, especially in old examples; tip of lower jaw yellow; lower part of dorsal yellow; peritoneum black. Body very slender, subsiform, slenderer and less compressed than a herring, the back rather broad. Ventral serratures very weak. Maxillary reach-

<sup>\*\*</sup> Vomerine teeth none.

<sup>\*</sup>Rafinesque, Ichth. Oh. 1820, 38: type Pomolobus chrysochloris Rafinesque.  $(\pi \tilde{\omega} u e, \text{operculum}; \lambda \sigma \beta \delta \tilde{\epsilon}, \text{lobe.})$ 

ing nearly to middle of eye. Mandible little projecting, the tip included. Gill-rakers longer than eye, very slender and numerous, close-set. Opercles, top of head, and scapular region with conspicuous branching tubes and striæ. Insertion of dorsal considerably nearer shout than base of caudal. Pectorals and ventrals with sheathing scales. Head 4; depth 5. D. 15; A. 17; Lat. l. 53; scutes 18+14. L. 12 inches. Pacific coast of North and South America; very abundant, spawning in the sea. Resembles the European Sardine (C. pilchardus), but has no teeth, and the belly less strongly serrate.

(Jenyus, Zoöl, Beagle, Fish. 134; *Meletta cœrulea* Girard, U. S. Pac, R. R. Surv, x, 330; *Alosa musica* Grd, U. S. Nav. Astron. Exped. Zoöl, 246; *Alausa californica* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 281; Günther, vii, 443.)

aa. Ventral serratures strong.

b. Jaws with persistent teeth, at least on premaxillaries, and sometimes on symphysis of lower jaw.

### 442. C. chrysechloris (Raf.) Jor. & Gilb. - Ohio Shad; Skipjack.

Brilliant blue above; sides silvery, with golden reflections; no dark spot behind opercle. Body elliptical, highest near the middle, much compressed. Head rather slender and pointed, its upper profile straight. Lower jaw strongly projecting, its tip entering the profile; upper jaw emarginate. Premaxillary, and often tip of lower jaw, with moderate-sized teeth. Maxillary large, reaching to opposite posterior part of eye. Eye large, well covered by adipose eyelid. Fins moderate. Caudal peduncle slender, the caudal widely forked. Gill-rakers comparatively few, short, stout, and coarse, about 23 below the angle of the arch. Opercles with radiating and branching striæ. Peritoneum pale. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ . Eye shorter than snout,  $4\frac{1}{3}$  in head. D. 16; A. 18; Lat. 1. 52; ventral scutes 20 + 13. L. 15 inches. Gulf of Mexico and Mississippi Valley; abundant, and resident in all the larger streams, and introduced through the canals into Lake Erie and Lake Michigan. A handsome fish, not valued for food.

(Pomolobus chrysochloris Raf. Ichth. Oh. 1820, 38.)

b. Jaws without persistent teeth; a few teeth usually present on the tongue. (Meletta Val.)

## 413. C. mediocris Mitchill.-Hickory Shad; Tailor Herring; Fall Herring.

Bluish silvery; sides with rather faint longitudinal stripes. Head comparatively long, the profile straight and not very steep, form more elliptical than in the others and less heavy forwards. Lower jaw considerably projecting; upper jaw emarginate. Opercles rather less emarginate below and behind than in *C. vernalis*. Fins low; dorsal

(Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 451: Clupea mattowacca Günther, vii, 438: Alosa lineata Storer, Proc. Bost. Soc. Nat. Hist. ii, 242, and Hist. Fish. Mass. 162.)

#### 411. C. vernalis Mitch.—Alewife; Branch Herring; Gaspereau.

Blue above; sides silvery; indistinct dark stripes along the rows of scales; a blackish spot behind opercle. Body rather deep and compressed, heavy forward. Head short, nearly as deep as long, the profile somewhat steep and slightly depressed above the nostrils. Maxillary extending to posterior margin of pupil. Lower jaw somewhat projecting; upper jaw emarginate. Eye large, slightly longer than snout, 3½ in head. Gill-rakers long, 30-40 below the angle of the arch, shorter and stouter than in *C. sapidissima*. Lower lobe of caudal the longer. Dorsal fin high, a little higher than long, its height 6½ in length of body. Head 4½; depth 3½. D. 16; A. 19; Lat. l. 50; scates 21 + 14. Peritoneum pale. Atlantic coast of the United States; abundant; entering streams to spawn; land-locked in the lakes of Western New York.

(Mitchill, Rept. Fish. N. Y. 22, and Trans. Lit. & Phil. Soc. N. Y. i, 454; Clupra pseudoharengus Wilson, Rees's Encycl.: Alosa tyrannus Storer, Hist. Fish. Mass. 156; Pomolobus pseudoharengus Gill, Rept. U. S. Fish Com. 1871-772, 811; Pomolobus rernalis Goode & Bean, Bull. Essex Inst. 1879, 24.)

### 445. C. æstivalis Mitchill.—Glut Herring; Blue-back.

Very similar to the preceding, from which it is best distinguished by the black peritoneum. The fins are lower and the eyes smaller. Atlantic coast, appearing later than the preceding; less abundant and less valuable as a food-fish.

(Clupea astivalis Mitch. Trans. Lit. & Phil. Soc. N. Y. i1, 1814, 456; Alosa cyanonoton Storer, Hist. Fish. Mass. 161; Pomolobus astivalis Goode & Bean, Bull. Essex Inst. 1879, 24.)

ttCheeks deeper than long, the preopercle scarcely prolonged anteriorly below; no teeth, or a few, caducous, on the jaws; shad. (Alosa Cuvier.\*)

## 446. C. sapidissima Wilson.—Common Shad.

Bluish above; sides white or silvery; a dark spot behind opercle, and sometimes several along the line dividing the color of the back from that of the sides; axil dusky; peritoneum white. Body comparatively deep. Month rather large, the jaws about equal, the lower fitting into a notch in the tip of the upper. Preorbital moderate. Cheeks much

<sup>\*</sup>Cuvier, Regne Anim. ed. 2, 1829: type Clupea alosa L. (Latin alausa or alosa, an early name of the shad; English allis, German alse, Latin halee.)

deeper than long, the preopercle extending little forward, joining the mandible at a point rather behind the eye. Gill-rakers extremely long and slender, much longer than eye, about 60 below the angle of the arch. Fins small. Dorsal much nearer snout than base of caudal. Head  $4\frac{1}{4}$ ; depth 3. D. 15; A. 21; Lat. l. 60; ventral scutes  $21 \pm 16$ . Atlantic coast of the United States; ascending rivers to spawn. One of the most important of our food-fish. Also introduced on the Pacific coast.

(Wilson, Rees's Encyclopedia: Alosa prastabilis DeKay, New York Fauna, Fish. 255: Alosa sapidissima of most late American writers.)

#### 123.—HARENGULA Valenciennes.

(Valenciennes, Hist. Nat. Poiss. xx, 277, 1847: type Harengula latulus Val.)

Characters essentially those of the genns *Clupea*, except that the scales are firm, adherent, and regularly arranged. (Latin diminutive of *harengus*, herring.)

#### 447. H. pensacolæ Goode & Bean.

Body deep, with projecting belly, formed much as in the shad. Head very short. Scales of the back in front of dorsal with radiating striae and sharply serrated edges; other scales smooth, with irregular but unarmed free margins; scales all marked with wavy lines, sometimes forming reticulations. Lower jaw rather long, maxillary extending beyond front of orbit. Teeth very small, inconspicuous in the jaws. A large patch of asperities on the tongue. Gill rakers fine, close set, shorter than the eye, about 56 below the angle. Eye large, longer than snout, 3 in head. Head 4; depth 3. D. 16; A. 17; Lat. l. 40; scutes 12 behind ventrals. Pensacola, Fla. (Goode & Bean.)

(Harengula pensacolæ Goode & Bean, Proc. U. S. Nat. Mus. 1879, 152.)

#### 124.—OPISTHONEMA Gill.

## Thread Herring.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 37: type Clupea thrissa Osbeck.)

Characters essentially those of Harengula, except that the last ray of the dorsal is produced in a long filament as in Dorosoma. ( $\tilde{c}\pi\iota\sigma\theta\varepsilon$ , behind;  $\nu\tilde{i}_{\mu}\mu a$ , a thread.)

#### 448. O. thrissa (Osbeck) Gill.

Bluish above; silvery below; an indistinct bluish shoulder-spot; each scale on the back with a dark spot, these forming longitudinal streaks. Body oblong, compressed. Belly strongly serrate. Tongue with minute teeth. Jaws toothless; lower jaw slightly projecting; maxillary reach-

ing nearly to middle of orbit. Gill-rakers very long and slender. Dorsal fin inserted in front of ventrals, much nearer snout than base of caudal. Dorsal filament about as long as head. Analyery low. Paired fins small. Scales rather firm, smooth. Head 4; depth 3½ in length. D. 19; A. 24; Lat. I. 50; scutes 17 + 14. Atlantic coasts of America, chiefly southward, the flesh said to be sometimes poisonous.

(Clupea thrissa Osbeck, Reise, 336: Clupea thrissa Günther, vii, 432: Clupea libertatis Günther, vii, 433, Pacific coast of Central and South America, is at least very similar.)

#### 125.—RREVOORTIA Gill.

### Menhadens.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 37: type Chapca menhaden Mitch. = Chapc tyrannus Latrobe.)

Body elliptical, compressed, deepest anteriorly, tapering behind. Head very large. Cheeks deeper than long. Mouth large, the lower jaw included. No teeth. Gill-rakers very long and slender, densely set. Gill-arches angularly bent. Scales deeper than long, closely imbricated, their exposed edges vertical, and fluted or pectinated. Dorsal fin low, rather posterior. Anal fin small. Intestinal canal elongate. Peritoneum dusky. Species few, inhabiting the Atlantic. (Dedicated to J. Carson Brevoort.)

\* Scales with their edges entire, fluted.

## 449. B. patronus Goode.

Head larger than in *B. tyrannus*. Fins long, the height of the dorsal greater than the length of the maxillary; that of the anal more than half the height of the maxillary. Pectorals reaching beyond front of ventrals; insertion of dorsal in front of ventrals, just behind the middle point between the snout and the base of the caudal. Scales moderate, with their margins entire, fluted. Axillary appendages large. Large scales at base of pectoral. Operculum delicately striated. Greenish gray above; sides silvery, with brassy lustre; scapular blotch inconspicuous. Head 3 in length; depth 2\frac{3}{3}. D. 19; A. 22; Lat. l. 50-65. Gulf of Mexico. (Goode.)

(Goode, Proc. U. S. Nat. Mus. i, 39, 1878.)

**450. B. tyrannus**\* (Latrobe) Goode,—Menhaden; Mossbunker; Bony-fish; White-fish; Bug-fish; Fat-back; Yellow-tail.

Head and jaws shorter than in B. patronus. Fins comparatively short,

<sup>\*\*</sup> Scales everywhere with their edges strongly serrated.

<sup>\*</sup>A parasitic Crustaeean (Oniscus prægustator Latrobe) is found in the mouths of a very large proportion of the individuals of this species. The specific names both of the fish and the Crustaeean refer to this p-culiarity, the ancient Roman rulers (tyranni) having had their tasters (prægustatores) to taste their food before them, to prevent poisoning.

the height of the dorsal less than the length of the maxillary; height of anal less than half the length of the maxillary. Pectorals not reaching to ventrals. Dorsal inserted slightly behind ventrals, about midway between snout and base of caudal. Scales moderate, strongly serrated, arranged very irregularly. Operculum strongly striated or almost smooth (var. anrea). Gill-rakers much longer than eye. Bluish above; sides silvery, with a strong brassy lustre; fins usually yellowish; a conspicuous dark scapular blotch, behind which are often smaller spots. Head  $3\frac{1}{5}$ ; depth 3. D. 19; A. 20; Lat. l. 60–80; ventral plates 20+12. L. 12–18 inches. New England to Brazil; very abundant southward, spawning in the sea. Held in no esteem as a food-fish, but very valuable for oil and manure; the young canned as sardines.

(Clupea tyrannus Latrobe, Trans. Amer. Phil. Soc. Phila. v, 77, 1802: Clupea menhaden Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 453; 1814: Clupea menhaden Günther, vii, 436: Clupanodon aureus Agassiz, Spix. Pisc. Bras. 52 (Brazilian var. aurea Goode): Clupea aurea Günther, vii, 437: Alosa menhaden Storer, Hist. Fish. Mass. 337; Goode, Proc. U. S. Nat. Mus. i, 5, 31, 1878; Goode, Rept. U. S. Fish Comm. for 1877, complete biography.)

## FAMILY XXXVIII.—DOROSOMATIDÆ.

(The Gizzard Shads.) ·

Body short and deep, strongly compressed, covered with thin, deciduous, cycloid scales. Belly compressed to an edge, which is armed with bony serratures. Head naked, short, rather small. Mouth small, inferior, oblique, overlapped by the blunt snout; no teeth. Maxillary narrow and short, with a single supplem ntal bone, not extending to opposite the middle of the eye, and forming but a small portion of the lateral margin of the upper jaw. Mandible short and deep, its rami enlarged at base. Premaxillary not protractile. Gill-rakers slender, exceedingly numerous, not very long, similar on all the arches. membranes not united, free from the isthmus. Pseudobranchiæ large. An adipose eyelid. No lateral line. Dorsal fin about midway of the body, usually behind ventrals. Pectorals and ventrals moderate, each with an accessory seale. Analyery long and low. Candal forked. No adipose fin. Stomach short, muscular, like the gizzard of a fowl. Genera 2, species about 12. Mud-eating fishes of the coasts and rivers of warm regions, of little value as food.

(Clupeida group Chatoëssina Giinther, vii, 406–411.)

#### 126.—DOROSOMA Rafinesque.

#### Girrard Shad

(Chatoëssus Cuvier, 1829.)

(Rafinesque, Ichth. Oh. 1820, 39: type Dorosoma notata Raf. = Clupca heterura Raf.)

Characters of the family, with the addition that the last ray of the dorsal is prolonged and filiform as in *Opisthonema* and *Megalops*. (δόρος, a lance;  $\sigma \tilde{\omega} \mu a$ , body; in allusion to the form of the body in the young.)

# 451. D. cepedianum (Le S.) Gill.—Gizzard Shad; Hickory Shad.

Silvery; bluish above; young with a round dark spot at the shoulder; tips of ventrals and edge of anal often dusky. Body deep, compressed, the back elevated in the adults. Dorsal about median, its filamentous ray about as long as head, sometimes longer, sometimes shorter. Caudal widely forked, the lower lobe the longer. Head  $4\frac{1}{3}$ ; depth  $2\frac{3}{3}$ . Eye  $4\frac{1}{2}$  in head. D. 12; A. 31; Lat. l. 56; L. transv. 23; scutes 17+12. L. 15 inches. Cape Cod to Mexico; abundant southward, entering all rivers, and permanently resident ("var. heterurum") everywhere in the Mississippi Valley in the larger streams; also introduced into Lake Michigan and Lake Erie, and land-locked in ponds from New Jersey to Nebraska and Texas. A handsome fish, of no value as food.

(Megalops cepediana Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 361: Chatoëssus cepedianus Günther, vii, 409: Clupea heterura Raf. Amer. Month. Mag. 1818, 354: Chatoëssus ellipticus Kirtland, Bost. Journ. Nat. Hist. iv, 235.)

# FAMILY XXXIX —ENGRAULIDIDÆ.

(The Anchovies.)

Body elongate, more or less compressed, covered with thin, cycloid scales. Head compressed. Mouth extremely large, nearly horizontal, usually overlapped by a pointed, compressed, pig-like snout. Gape very wide, the maxillary very long and slender, formed of about three pieces, extending backward far behind the eye; in some genera, much beyond the head. Premaxillaries not protractile, very small, firmly joined to the maxillaries. Teeth small, variously arranged, usually fine and even, in a single row in each jaw. Eye large, well forward, so that the snout is very short. Preorbital narrow. Opereles little developed, membranaceous. Gill-rakers long and slender. Branchiostegals slender, 7–14 in number. Gill-membranes separate or joined, free from the isthmus. Pseudobranchiæ present. No lateral line. Belly rounded or weakly

serrate. Fins various. No adipose fin. Caudal forked. Small fishes; usually swimming in large schools. Abundant in all warm seas, occasionally entering rivers. Genera 9, species about 60.

(Cluncidae group Engraulidina Günther, vii, 383-406.)

\* Gill-membranes scarcely connected, the gill-openings being extremely wide; no pectoral filaments; anal fin moderate, its origin behind that of the dorsal; apper jaw projecting beyond lower; maxillaries not extending beyond gill-openings; teeth small, or wanting, in one or both jaws...Stolephorus, 127.

#### 127.—STOLEPHORUS Lacépède.

#### Anchovies.

(Engraulis Cuvier, 1817.)

(Lacépède, Hist. Nat. Poiss. v, 381, 1803: type Atherina japonica Gmelin.)

Body oblong, compressed, covered with rather large, thin, decidnous scales. Snout conical, compressed, projecting. Maxillary extending backward far behind eye, about to the base of the mandible. Operculum narrow, membranaceous. Teeth small, usually on the jaws, vomer, palatines, and pterygoids, those of one or both jaws sometimes obsolete. Anal fin moderate, free from caudal (its rays 15–40). No pectoral filaments. Dorsal about midway of body, posterior to ventrals. Pectorals and ventrals each with an accessory scale. Adipose eyelid obsolete. Branchiostegals 9–14. Gill-membranes not united, leaving the narrow istlmus uncovered. Species about 25, in all warm regions.  $(\sigma \tau \omega \lambda \eta')$ , a stole, a white band worn by priests;  $\varphi \sigma \rho \delta \tau$ , bearing; in allusion to the silvery lateral band.)

\*Teeth fine, even, numerous, persistent in both jaws. +Sides without distinct silvery band.

# 452. S. ringens (Jenyns) Jor. & Gilb.—Anchory.

Bluish above; sides and below silvery, not translucent. No silvery lateral band. Body little compressed, rounded above, slightly carinated below, not serrated. Head long, anteriorly compressed, the snout pointed and protruding. Head nearly twice as long as deep. Eye large, very near the tip of the snout. Maxillary extending beyond root of mandible. Opercle deeper than long, placed very obliquely. Gillrakers very long, much longer than the eye. Head 3½; depth 5½. D. 14; A. 22; Lat. l. 40; B. 14. L. 7 inches. Pacific coast, from Vanconver's Island to Peru; extremely abundant. The largest of our anchovies.

(Engraulis ringens Jenyns, Voyage Beagle, 136: Engraulis ringens Günther, vii, 386: Engraulis mordax Girard, U. S. Pac. R. R. Snrv. x, 334: Engraulis nanus Girard, l. c.

335 (much smaller and more compressed, probably the young of *S. vingens*, but occurring in large schools): *Engraulis pulchellus* Girard, U. S. Nav. Astrou. Exped. Zoöl. Fish. 247.)

tt Sides with a distinct silvery lateral band.

4

‡ Belly compressed to an edge and faintly serrated.

#### 453. S. browni (Gmel.) J. & G.—Anchory.

Olivaceous; sides silvery; the silvery lateral band about as wide as the eye, very distinct, more so than in our other species. Body rather elongate, compressed, not elevated. Head rather short, the snont projecting much beyond the tip of the lower jaw. Teeth pretty strong, maxillary extending beyond base of mandible, but not quite reaching to the edge of the gill-opening. Eye large, 3½ in head. Gillrakers long, but shorter than in S. compressus. Anal with a sheath of scales; dorsal inserted nearer caudal than snout. Head 3¾; depth 4¾. D. 12; A. 20; Lat. l. 40. L. 4-6 inches. Cape Cod to Brazil; very abundant southward.

(Atherina browni Gmel. Syst. Nat. 1397; Günther, vii, 389; Clupca vittata Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 456; Engraulis mitchilli Günther, vii, 391; Engraulis vittatus of most recent writers.)

### 454. S. hiuleus (Goode & Bean) Jor. & Gilb.

Snout somewhat compressed. Maxillary slightly dilated, ending in an acute point, which extends backward to the gill-openings, toothed along its entire lower edge; minute teeth in both jaws. Gill-rakers not very numerous, the longest as long as the eye. Origin of dorsal midway between posterior margin of orbit and the root of the caudal. Lateral stripe one-third the height of the body. Head  $3\frac{3}{5}$  in length; depth  $5\frac{1}{2}$ . Eye greater than snout. D. 15; A. 22. (Goode & Bean.) Clear Water Harbor, Florida. Evidently closely related to 8. browni.

(Engraulis hiuleus Goode & Bean, Proc. U. S. Nat. Mus. ii, 343, 1579.)

## Belly not carinated or serrated.

a. Body not strongly compressed, very slender.

## 455. S. perfasciatus (Pocy) Jor. & Gilb.

Body elongate, much slenderer than in *S. browni*, and not so much compressed. Head not so deep as in *S. browni*, more pointed, the snont rather sharp. Eye rather small,  $4\frac{1}{2}$  in head, not longer than snout. Maxillary teeth well developed; mandibulary teeth very slender. Gill-rakers very long, as long as eye. Maxillary shorter than in *S. browni*, not reaching quite to the base of the mandible. Belly slightly compressed, not serrated. Scales very decidnous. Ventrals short, very

Bull. Nat. Mus. No. 16-18

slightly in front of dorsal. Caudal peduncle long and slender. Dorsal inserted scarcely nearer caudal than snout. Silvery stripe broad, half wider than the eye, bordered above by a dusky streak. Head  $3\frac{4}{5}$ ; depth 6. D. 12; A. 20. L. 4 inches. West Indies; occasional northward. A specimen in our collection from Wood's Holl, Mass.

(Engraulis perfasciatus Poey, Mem. Cuba, ii, 312: Eugraulis perfasciatus Günther, vii, 391.)

aa. Body strongly compressed, translucent in life.

## 456. S. delicatissimus (Girard) Jor. & Gilb.

Very pale, olivaceous, translucent, with some dark points, and a silvery lateral band not as wide as the eye. Head short, nearly as deep as long. Eye large, much longer than the blunt snout, which projects considerably beyond the lower jaw. Gill-rakers numerous, slender, nearly as long as the eye. Maxillary reaching past the root of the mandible. Lower lobe of caudal the longer. Anal rather long. Dorsal inserted midway between caudal and front of eye. Head  $4\frac{1}{4}$ ; depth  $4\frac{3}{4}$ . D. 13; A. 23. Lat. l. 40. L. 3 inches. San Diego Bay and southward; locally abundant.

(Eugraulis delicatissimus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 154, and U. S. Pac. R. R. Surv. x, 333: Eugraulis delicatissimus Günther, vii, 391.)

## 457. S. compressus (Girard) Jor. & Gilb .- "Sprat."

Very pale, olivaceous, translucent; a silvery lateral band as broad as the eye. Body strongly compressed, deeper than in other species. Head short, nearly as deep as long. Eye large, anterior, much longer than the blunt shout, which does not project much beyond the lower jaw. Gill-rakers numerons, slender, nearly as long as the eye. Maxillary reaching beyond the root of the mandible. Lower lobe of caudal the longer. Anal fin very long. Dorsal inserted midway between caudal and front of eye. Pectoral with a basal sheath. Head  $4\frac{1}{2}$ ; depth  $3\frac{3}{4}$ . D. 12; A. 31. Lat. l. 40. L. 6 inches. Very similar to 8. delicatissimus, but larger, with a longer anal fin. Point Concepcion to Mexico; abundant southward.

(Engraulis compressus Girard, U. S. Pac. R. R. Surv. Fish. 335: Engraulis compressus Günther, vii, 395.)

# FAMILY XL.—ALEPIDOSAURIDÆ.

(The Lancet-fishes.)

Body elongate, rather compressed, scaleless. Head compressed, with the snout much produced, and with the cleft of the mouth very wide. Premaxillary very long and very slender, forming the entire margin of the upper jaw, not protractile. Maxillary thin, needle-like, as long as

the premaxillary, immovable. Teeth very unequal, immovable, and subject to many variations in the same species; a series of small teeth the entire length of the premaxillary; those in front sometimes larger Palatine teeth compressed, triangular, pointed; two or three of the anterior ones exceedingly long and strong, fang-like; the posterior ones moderate. Teeth of the lower jaw similar to those on the palatines, one pair in front and two or three pairs in the middle being much enlarged. No teeth on the tongue. Eye large, Gill-openings very wide; the gill-membranes not united, free from the isthmus. Gillrakers stiff, shortish, spine-like. Branchiostegals 5-7. Pseudobranchiæ large. Opercular bones thin, membranaceous, Dorsal fin very long, occupying nearly the whole of the back, of more than 40 rays; adipose fin present, moderate; anal fin moderate; caudal fin forked. Air-bladder none. Large fishes of the deep seas, found in the Atlantic and Pacific. One genus and 6 or 8 species. Every part of the Alepidosaurus is so fragile that it is extremely difficult to procure specimens. The structure of the dorsal fin is so delicate that it must be liable to injury even in the water: the bones are very feebly ossified, and the fibrous ligaments connecting the vertebra are very loose and extensible, so that the body may be considerably stretched. "This loose connection of the single parts of the body is found in numerous deep-sea fishes, and is merely the consequence of their withdrawal from the pressure of the water to which they are exposed in the depths inhabited by them. When within the limits of their natural haunts the osseous, muscular, and fibrous parts of the body will have that solidity which is required for the rapid and powerful movements of a predatory fish. That fishes of this genus (Alepidosaurus) belong to the most ferocious of the class is proved by their dentition and the contents of their stomach, but it is worthy of notice that although the month is so deeply eleft, the lower jaw cannot be moved from the upper at a greater angle than about 40°." (Günther.)

 $(Scopelidæ, \ {\rm group}\ Alepidosaurina\ G"inther,\ v,\ 420-423.)$ 

#### 128.-ALEPIDOSAURUS Lowe.

## Lancet-fishes.

(Alepisaurus Lowe, Proc. Zoöl. Soc. Lond. 1833, 104: type Alepisaurus ferox Lowe.)

Characters of the genus included above. The name *Plagyodus* Steller (Pallas, Zoogr. Ross. Asiat. iii, 383) has been lately accepted by Dr. Günther for this genus. A specimen of one of the Pacific species was obtained by Steller from the Kurile Islands, and a brief description of

it, under the name of *Plagyodus*, left by him in manuscript, was afterwards quoted by Pallas, without indorsement. Steller wrote before Linnaus, and apparently used the name *Plagyodus* as a mononomial designation for his particular specimen or species, and not in the sense of a Linnaun genus. It seems to us, at present, best to retain the name *Alepidosaurus*. (a, privative;  $\lambda z\pi i z$ , scale;  $\sigma a \delta \rho v z$ , Saurus = Synodus.)

\* Ventral rays 9 or 10. (Alepidosaurus.)

### 458. A. ferox Lowe. - Laneet-fish.

The length of the head is twice the height of the body, and rather less than one-sixth of the total. Eye median, 6 in head, as wide as the interorbital space. Dorsal fin much elevated; pectorals elongated, but not reaching nearly to ventrals; first ray of dorsal, pectoral, and ventral serrated. Upper caudal lobe produced into a long filament. D. 41–44; A. 14–17; P. 14–15; V. 9–10. (Günther.) Deep waters of the Atlantic; lately obtained off the coast of Massachusetts by the United States Fish Commission. A specimen of this or some closely-related species has been procured by Dr. Bean in Alaska.

(Alepisaurus ferox Lowe, Trans. Zoöl. Soc. Lond. i, 305; Günther, v, 421.)

\*\*Ventral rays 13. (Caulopus Gill.\*)

### 459. A. borenlis Gill.—Handsaw-fish.

Dorsal fin with about 34 rays, the first of which is rather stout, and anteriorly has a prominent compressed ridge, which is crenulated in front. Ventral fins at least as long as the head. V. 13; B. 5. Monterey to Alaska; occasionally cast on shore.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 128: Alepidosaurus borealis Günther, v, 423: Caulopus serra Gill, Proc. Acad. Nat. Sci. Phila. 1862, 131, from Monterey; known by a mutilated specimen only, which "differs from C. borealis by the oblong operculum, the nearly equal triangular shape of the coalescent infraopercular bone above the dividing ridge, but with an oblique excavation at its base, which describes nearly the third of a circle, as well as the sculpture of the portion below the dividing ridge".)

# FAMILY XLI.—PARALEPIDIDÆ.

# (The Paralepids.)

Body elongate, somewhat compressed, formed much as in a Barracuda, covered with cycloid scales of moderate or rather large size. Head long, usually scaly on the sides. Mouth very large, lower jaw projecting. Premaxillary not projectile, very long and slender, forming the entire margin of the upper jaw. Maxillary long and slender, closely adherent

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1862, 128: type Alepisaurus altivelis Poey, from Cuba. (μαυλόξ, stem; πούξ, foot; i. e., ventral fins of many stems or rays.)

to the premaxillary. Teeth rather strong, pointed, in single series on the jaws and palatines; some of them on lower jaw and palatines sometimes very long and fang-like, and most of them freely depressible. Opercular bones thin. Pseudobranchiae present. Gill-membranes separate, free from the isthmus. Branchiostegals about 7. Gill-rakers short, sharp, spine-like. Eye large. Lateral line present, its scales usually enlarged. Dorsal fin short and small, behind the middle of the body, nearly or quite over the ventrals. Adipose fin present; anal fin low, rather long; caudal fin short, narrow, forked; pectorals rather small, placed low. Pyloric coca none. No air-bladder. Phosphorescent spots few or none. Fishes of the deep waters of the Atlantic and Pacific, resembling Sphyrana in form and dentition. A single genus and about 5 species are now known.

(Scopelidæ, g oup Paralepidina Günther, v, 418, 420.)

## 129.—SUDIS Rafinesque.

(Paralepis Risso.)

(Rafinesque, Caratteri di Alenni Nuovi Generi, etc. 1810, 60: type Sudis hyalina Raf. of the Mediterranean.)

Characters of the genus included above. Two genera are usually recognized, differing in the development of the canines of the lower jaw, a character which appears to be of minor importance. (Latin *sudis*, a stake, an ancient name of *Sphyrana*.)

\*Lower jaw with 3-5 very long fang-like teeth on each side. (Sudis.)

#### 460. S. ringens Jordan & Gilbert.

Body very slender and elongate, compressed, the depth forming about one-sixteenth of the length. Head rather slender, anteriorly pointed and moderately depressed. Mouth large, horizontal, the gape extending more than half the length of the head. Margin of the upper jaw formed entirely by the very slender, nearly straight premaxillaries, which are closely appressed to the long and slender maxillaries. Maxillaries extending to below the eye, nearly as far as the mandibular joint. Tip of upper jaw emarginate; tip of lower jaw rather broad, turned up, and fitting in the notch of the upper jaw. Premaxillaries armed with a series of small, sharp, subequal, close-set teeth, which are hooked backward; a long, slender canine in front on each side. Lower jaw with about 10 sharp, slender teeth on each side, these teeth very unequal, some of them short, three or four very long and canine-like. Near the front is one fang-like tooth on each side, then a considerable interspace,

behind which the others are arranged partly in two rows. Most of these teeth, especially the inner and larger ones and the anterior canines, are freely depressible. A long series of teeth on the palatines, one or two of the anterior teeth on each side and one or two others long, slender, and fang-like. Tongue free anteriorly, roughish, but apparently without teeth. Scales very large, cycloid. Dorsal fin inserted somewhat behind the middle of the body, at a distance of nearly 4 times its base in front of the anal, its height a little greater than the length of its base. D. 11; A. 25. Anal fin anteriorly nearly as high as the dorsal, its posterior rays low. Pectoral fins placed low, rather short, about as long as the maxillary. Caudal fin short, narrow, apparently forked. Ventrals (lost in the type) probably in front of the dorsal. Coloration light olive, the sides silvery, with dark punctulations. Peritoneum silvery, underlaid by black pigment. Santa Barbara Channel, California.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 273.)

a. Ventral fins inserted behind the dorsal. (Arctozenus Gill.)

## 461. S. Dorealis (Reinhardt) Jordan & Gilbert.

Olivaceous. Snout as long as rest of head; mandible included, its upturned tip fitting into an emargination of upper jaw. Teeth as in *S. coruscans*, but considerably stronger. Pectoral and ventral fins small, the latter inserted behind the dorsal. Head  $4\frac{1}{3}$ ; depth 12. B. 7; D. 8; A. 32; P. 11; V. 9. Greenland to Gulf of Saint Lawrence.

(Paralepis borcalis Reinhardt, Naturv. Mathem. Afhandl. vii, 115: Paralepis borcalis Günther, v, 418: Arctozenus borcalis Gill, Proc. Acad. Nat. Sci. Phila. 1864, 188.)

#### 462. S. coruscans Jor. & Gilb.

Dusky olivaceous; sides of head silvery; bases of fins generally black; rami of mandible each with a double series of minute phosphorescent spots. Body very elongate, of nearly uniform depth, the caudal peduncle very slender; abdomen compressed. Head long; snout sharp, half length of head. Eye large, high. Jaws equal; maxillary reaching vertical from nostril; tip of lower jaw fitting into an emargination of premaxillaries. None of the teeth fang-like; premaxillaries laterally with minute teeth; 4 or 5 longer teeth in front; vomer with minute teeth; anterior palatine teeth long, the posterior short; teeth of lower jaw slender, distant, unequal. Scales deciduous, those of lateral line enlarged. Fins all very small; ventrals entirely behind

<sup>\*\*</sup>Lower jaw without fang-like teeth. (Paralepis Risso.\*)

<sup>\*</sup>Risso, Eur. Mérid. iii, 472, 1826: type Coregonus paralepis Risso. (παρά, near; λεπίς, scales.)

dorsal, their distance from front of orbit twice that from base of caudal; distance of front of dorsal to base of caudal half its distance from tip of snont; caudal widely forked. Head 4; depth 13. D. 8; A. 31; P. 11; V. 9. Lat. 1. 60. Puget Sound, scarcely differing from the preceding, the teeth a little weaker.

(Paralepis coruscans Jor. & Gilb. Proc. U. S. Nat. Mns. 1880, 411.)

# Family XLII.—SCOPELIDÆ.

(The Scopelids.)

Body oblong or elongate, compressed or not, naked or covered with scales, which are usually eyeloid. Mouth very wide, the entire margin of the upper jaw formed by the long and slender premaxillaries, closely adherent to which are the slender maxillaries, the latter sometimes rudimental or obsolete. Teeth various, mostly cardiform on both jaws. tongue, and palatines; canines often present; large teeth usually depressible. No barbels. Opercular bones usually thin, often incomplete. Gill-membranes separate, free from the isthmus. Branchiostegals usually numerous. Pseudobranchiæ present. Gill-rakers various. Lateral line usually present. Cheeks and opercles commonly scaly. Adipose fin present in most of the genera. Dorsal fin short, median or rather anterior, of soft rays only. Pectorals and ventrals present. Anal fin moderate or long. Candal forked. Skeleton weakly ossified. Airbladder small or wanting. Intestinal canal short. Sides sometimes with phosphorescent spots. Eggs inclosed in the sacs of the ovary and extruded through an oviduct. Genera 10, species about 50, mostly inhabiting deep water in warm regions.

(Scopelida: group Saurina Giinther, v. 393-417.)

#### 130 .- SYNODUS Bloch & Schneider.

## Lizard-fishes.

(Saurus Cuvier, 1817.)

(Gronovius; Bloch & Schneid, Ichth, 1801, 396; type Esox synodus L.)

Body oblong or elongate, nearly terete. Head depressed, the snout triangular, rather pointed. Interorbital region transversely concave.

<sup>\*</sup>Body without phosphorescent spots. (Synodontina.)

<sup>\*\*</sup>Body with phosphorescent spots. (Scopeling.)

Month very wide: premaxillary not protractile, very long and strong, more than half the length of the head; maxillary closely connected with it, very small or obsolete. Premaxillary with one or two series of large, compressed, knife-shaped teeth, the inner and larger depressible. Palatine teeth similar, smaller, in a single broad band. Lower jaw with a band of rather large teeth, the inner and larger teeth depressible: a patch of strong, depressible teeth on the tongue in front, and a long row along the hyoid bone. Jaws nearly equal. Eye rather large, anterior. Supraorbital forming a projection above the eye. Pseudobranchiæ well developed. Gill-rakers very small, spine-like. membranes slightly connected. Top of head naked. Cheeks and opercles scaled like the body. Body covered with rather small, adherent, cycloid scales. Lateral line present. No phosphorescent spots. Dorsal fin short, rather anterior. Pectorals moderate, inserted high. Ventrals anterior, not far behind pectorals, large, the inner rays longer than the outer. Anal short. Caudal narrow, forked. Branchiostegals 12-16. Stomach with a long, blind sac and many pyloric ceea. Skeleton rather Species numerous. Voracious fishes of moderate size, inhabiting sandy bottoms at no great depth. In most warm seas. (συνόδους, ancient name of some fish, from συνόδους, teeth meeting, not shutting past each other like seissors.)

\* Snout rather pointed, longer than eye; upper jaw the longer. (Synodus.)

### 463. S. fætens (L.) Gill.-Sand Pike; Lizard-fish.

Olivaceous; yellowish below; back, mottled; upper surface of head brownish, distinctly vermiculated with yellowish; ventral fins, lower side of head, and inside of mouth tinged with yellow. Eye moderate, 5½ in head. Scales less regularly a:ranged and the rows less oblique than in S. lucioceps; those on the opercle in about 5 rows, on the cheeks in 7; 25–30 scales along back before dorsal, 4 in a vertical row between adipose fin and lateral line, 5 in an oblique row. Pectoral fin short, not reaching ventrals, its length three-fourths that of the premaxillary. Ventral large, its length from outer edge of base greater than from tip of snout to upper edge of gill-opening. Interorbital space considerably concave, with radiating ridges. Head  $4\frac{1}{4}$ . B. 12; D. 11; A. 11; V. 8; scales 7–64–8 (the vertical rows counted obliquely). L. 12 inches. Cape Cod to South America; common southward. Not valued as food.

(Salmo fatens L. Syst. Nat.: Saurus fatens Günther, v, 396: Saurus fatens Holbrook, Ichth. S. Car. 187.)

### 461. S. luciocens (Ayres) Gill.

Olive-brown above, grayish below, with some golden lustre on sides; back with slaty reticulations; head not vermiculated above; lower side of head and ventral fins yellow. Eye 5 in head. Scales arranged in regular, very oblique rows; those on the opercles in about 8, on the cheeks in about 9 rows; 40–50 scales along the back before the dorsal, 6 in a vertical row between adipose fin and lateral line, and 10 in an oblique row. Pectoral fin longer, reaching base of ventrals, its length about equal to that of the premaxillary. Ventral fin not so long as the space between snout and upper edge of gill-opening. Interorbital space little concave, nearly smooth. Head 4; depth 84. D. 11; A. 12; B. 14; scales 13–66–16 (the vertical series counted obliquely). L. 12 inches. San Francisco to Mexico; rather common in summer.

(Saurus lucioceps Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 66: Saurus lucioceps Günther, v, 397.)

\*\* Body rather stout; snout short, obtuse, shorter than eye; lower jaw the longer. (Trachinocephalus Gill.\*)

### 465. S. myops (Forster) Jor. & Gilb.

Grayish, mottled or barred; scapula black. Body moderately elongate, tapering backwards. Mouth very large, maxillary more than half length of head; snout shorter than eye; lower jaw somewhat projecting; top of head corrugated; interorbital space concave. Anal fin comparatively long. Ventral fins very long, reaching about to the vent. Head  $3\frac{1}{3}$  in length; depth about 5. D. 11; A. 14; scales 4–58–7. Tropical seas; not common on our South Atlantic coast.

(Salmo myops Forster, MSS. Bloch & Schneider, 421: Saurus myops Günther, v, 398.)

#### 131.-MYCTOPHUM Rafinesque.

(Scopelus Cuvier, 1817.)

(Rafinesque, Indice d'Ittiologia Siciliana, 1810: type Myctophum punctatum Raf.)

Body oblong, compressed, covered with large cycloid scales, those of the lateral line sometimes enlarged. A series of round luminous spots along the lower side of the head and body. Head compressed. Mouth large, the jaws usually about equal; premaxillary very long, slender; maxillary well developed. Teeth in villiform bands on jaws, palatines, pterygoids, and tongue. Eye large. Gill-rakers very long and slender. Branchiostegals 8–10. Pseudobranchia large. Air-bladder small. Py-

<sup>\*</sup>Gill, Cat. Fish. East Coast N. Amer. 1861, 53, no description: type Salmo myops Forster. (τραχινος, Trachinus; κεψαλή, head.)

loric ereca few. Dorsal fin near the middle of the body; ventrals usually below it, with 8 rays; pectorals well developed; adipose fin small; anal usually long. Small fishes of the open seas in most regions; species numerous. Several undescribed species have been lately taken off our Atlantic coast by the U. S. Fish Commission. ( $\nu \delta \xi$ , night;  $\xi^{a\xi}$ , light; hence amended by Cocco to Nyetophus.)

#### 466. M. cremulare Jordan & Gilbert.

Body much compressed, deepest in front of the base of the pectorals, bluntly convex anteriorly, tapering behind. Ventral region much more arched than dorsal. Caudal peduncle long and very slender. Head short and high, abruptly rounded in profile, the snout very blunt. Jaws equal, the shout not projecting beyond the mouth. very slender, scarcely widened to its tip, and not dilated, its extremity reaching beyond the eye to the margin of the preopercle. Premaxillaries anteriorly on a level of the pubil. Teeth very small, present on all the dentigerous bones. Rami of the mandible nearly parallel, coming together in a sharp keel below. Orbital margin above and in front with a thin membranaceous rim, that in front distinct and formed by the upturned edge of the preorbital. No orbital spine. Nasal bones membranaceous, their edges upturned, forming a horizontal groove. A groove between the frontal bones. Orbital margins separated by a groove from the preopercle. Margin of preopercle very oblique. All the membrane bones extremely thin, papery. Eye large, 3\{\frac{1}{3}} in head. Gill-rakers long and slender. Head 33 in length to base of candal; depth 43. Head and body completely covered with thin membranaceous scales, those on the middle of the sides not elevated and not noticeably larger than the others. Free edges of all the scales crenulate, some of them, especially on the back, with the crenations acute, but without spines, the scales being truly cycloid. About 45 scales in a longitudinal series. A phosphorescent spot on each mandible near the symphysis, 33 pairs of spots along the belly, 6 in front of ventrals, 6 between ventrals and origin of anal, and 21 between front of anal and base of caudal. Caudal pedancle above and below with two or three backward-directed spines, which are apparently the exserted tips of vertebral processes. D. 12; A. 16; the fins rather low. Origin of dorsal nearer the snout than the base of caudal, much behind the base of the ventrals. Ventrals short, not reaching half way to vent. Pectorals reaching base of ventrals. Color very dark steelblue above, silvery on sides and below, with dark metallic lustre; the

usual phosphorescent spots present, as above described; no evident cream-colored blotch on the back of tail. L. 2½ inches. Santa Barbara Channel, California.

(Jordan & Gilbert, Proc. U. S. Nat. Mns. 1880, 274.)

### 467. M. glaciale (Reinh.) J. & G.

Snont very short and obtuse, with the upper profile descending in a very strong curve; cleft of mouth oblique; maxillary reaching to the angle of the preoperculum, and terminating in a triangular dilatation. Scales smooth, those of the lateral line enlarged. Eye very large, more than one-third the length of head, which is nearly as deep as long. Depth 4, nearly equal to length of head. D. 13; A. 17; V. S. Lat. l. 36. Coasts of Scandinavia and Greenland. (Günther.)

(Scopelus glacialis Reinhardt, Dansk. Vidensk. Selsk. 1838, vii, 112, 126: Scopelus glacialis Günther, v, 407.)

# FAMILY XLIII.—STERNOPTYCHIDÆ.

## (The Sternoptychids.)

Body oblong or ovate, naked. Month very wide, its cleft oblique or vertical. Margins of upper jaw formed laterally by the maxillaries, the edges of which are toothed. Teeth pointed, mostly small. Opercular apparatus incomplete. Gill-openings very wide, the membranes not connected, free from the isthmus. Pseudobranchiae present. Gill-rakers long or short. Lower part of body and head with series of phosphorescent spots. Adipose fin present, often small. Dorsal fin moderate, usually median, sometimes preceded by a rudimentary spinous dorsal. Eggs extruded through oviduets. Skeleton imperfectly ossified. Small fishes of the deep seas. Genera 4; species about 12.

(Sternoptychide groups Sternoptychina and Cocciina Giinther, v, 384-391.)

#### 132.-MAUROLICUS Cocco.

#### Argentines.

(Cocco, Lettere sui Salmoni, 32: type Maurolicus amethystinopunctatus Cocco.)

Body oblong, compressed, naked, covered with silvery pigment; series of phosphorescent spots along the lower side of the head, body, and tail. Head compressed, the bones thin, but ossified. Cleft of mouth wide, oblique, the lower jaw prominent. Maxillary large, broad, much produced backwards, receiving the slender premaxillary in the upper

concave part of its margin. Both jaws with minute teeth. Gill-rakers very long. Pectorals and ventrals developed. Dorsal well back, but before anal. Adipose fin rudimentary. Anal fin long. Branchiostegals 8 or 9. Size small. Species about 4. (Dedicated to Maurolico, an Italian naturalist.)

\*Phosphorescent organs appearing as impressions on the skin.

### 468. M. borcalis (Nilss.) Günther.

Dark greenish, sides silvery. Body compressed. Mouth wide, the lower jaw much projecting. Teeth small. Eye large, 3 in head. Five luminous spots on the throat, 12 between pectorals and ventrals, above these a row of 8, 5 between ventrals and anal, vent to tail 24. Dorsal nearer tail than snout. Adipose fin very small. Ventrals below dorsal. Caudal forked. Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{4}$ . D. 10; A. 15. L.  $2\frac{1}{4}$  inches. (Storer.) North Atlantic; rare off our coasts.

(Scopelus borealis Nilsson, Observ. Zool. 9; Günther, v, 389; Scopelus humboldti DeKay, N. Y. Fauna, Fish. 246; Scopelus humboldti Storer, Hist. Fish. Mass, 328 (not of Cuvier).

## FAMILY XLIV.—CHAULIODONTID. E.

(The Chauliodonts.)

Body oblong or elongate, compressed, covered with rather large, thin, deciduous scales. Lateral line present. No barbels. Series of phosphorescent spots running along the lower side of the head, body, and tail. Head much compressed, the bones thin, but ossified. Month with the eleft extremely wide, its margins formed by maxillaries and premaxillaries, both of which are provided with teeth. Teeth unequal, some of them long and pointed, fang-like. Pectorals and ventrals well developed. Adipose fin present. Caudal forked. Gill-openings very wide. No pseudobranchiæ. No air-bladder. Deep waters of the Atlantic. Genera 2, Gonostoma and Chauliodus, differing widely in the position of the dorsal, the size of the anal, and the development of the gill-rakers; 2 species are known.

(Sternoptychidæ group Chauliodontina Günther, v, 391, 392.)

\*Dorsal in front of ventrals; no gill-rakers; anal with less than 20 rays.

Chauliodus, 133.

### 133.-CHAULIODUS Bloch & Schneider.

## Viper-fishes.

(Bloch & Schneider Syst. Ichth. 1801, 430: type *Chauliodus sloani* Bloch & Schneider.)

Body elongate, compressed, covered with very thin decidnous scales of moderate size. Head short, much compressed and elevated, the

lower jaw projecting, the snout much shorter than eye. Mouth extremely wide, the cleft reaching much beyond eye. Premaxillaries with four long fang-like canines on each side. Mandible with pointed, wide-set teeth, the anterior ones excessively long; none of these large teeth received within the mouth. Maxillaries with fine teeth; palatine with a single series of small pointed teeth; no teeth on the tongue. Eye moderate. Pectorals moderate. Ventrals large. Dorsal fin high, placed anteriorly, well in front of the ventrals. Adipose fin moderate, sometimes fimbriate, opposite the low, short anal. Caudal moderate, forked. Gill-openings very wide. No gill-rakers. Branchiostegals numerous. (γαύλισς, exserted; ὁδοὺς, tooth.)

#### 469. C. sloani Bloch & Schneider.

Greenish above; sides silvery; belly blackish. Dorsal not far behind head, its first ray produced in a long filament. Pectoral fins short. Ventral fins elongate, longer than head. About 30 phosphorescent dots in a series from the chin to the ventrals. Scales of the body subhexagonal. Head nearly as deep as long, 7 in total length; depth about the same. B. 17; D. 6; A. 12; V. 7; Lat. l. 56. L. 12 inches. (Günther.) Mediterranean and deep waters of the Atlantic; a specimen found in the stomach of a cod on George's Banks.

(Bloch & Schneider, 430; Günther, v, 392.)

## FAMILY XLV.—STOMIATIDÆ.

(The Stomiatoids.)

Body elongate, naked or covered with thin decidnous seales. Mouth very wide. Lateral margin of upper jaw formed by the maxillaries, which are provided with teeth along their edges. Teeth usually very strong, unequal, some of them often fang-like. Gill-membranes not joined, free from the isthmus. Branchiostegals numerous. A long fleshy barbel suspended from the throat. No pseudobranchiae. Sides with phosphorescent spots. Dorsal fin short, median or posterior, without spines. Adipose fin present or absent. Pectorals and ventrals present. Opercular apparatus incomplete. Skeleton feebly ossified. Eggs excluded through oviducts. Deep-sea fishes of the Atlantic. Genera 4; species 8 or 10.

(Stomiatida Günther, v, 424.)

<sup>\*</sup>No adipose fin; dorsal opposite anal. (Stomiatina.)

b. Vomer and palatines with teeth...... Echiostoma, 135. \*\* Adipose fin present; dorsal in front of anal; body naked. (Astronesthina.)

ASTRONESTHES, 137.

#### 124.—STONIAS Cuvier.

(Cuyier, Règne Anim. ii, 1817: type Esox boa Risso, from the Mediterranean.)

Body elongate, compressed, covered with exceedingly fine and deciduons scales, which are scarcely imbricated, lying in subhexagonal depressions in the skin. Head compressed, the snout very short and the cleft of the month extremely large. Month oblique, the lower jaw projecting. Teeth pointed, unequal, those of the premaxillaries and maudible very large; maxillary with fine teeth; vomer with a pair of fangs; palatines and tongue with smaller pointed teeth. Eye moderate. Opercular portion of the head short; a large fleshy barbel suspended from the hyoid region. Vent far back. Dorsal comparatively long, far back, opposite the anal. Pectorals and ventrals rather small and short, the latter for back. Candal fin moderate. Lower side of head, body, and tail with series of phosphorescent dots. Gill-openings very wide. No pyloric ecca. Singular fishes of the deep waters of the Atlantic. (στόμιας, "mouthy," from στόμα, mouth.)

\* Hyoid barbel not fringed.

#### 470. S. ferox Reinhardt.

Black. Neither pectorals nor ventrals produced. Caudal rounded. Depth about 12 in total length; head 10. D. 17; A. 21; P. 6; V. 6. (Günther.) Greenland, south to Cape Cod, in deep water.

(Reinhardt, Vidensk. Selsk. Natury, etc. x, p. lxxvii; Günther, v, 426.)

#### 135.—ECHIOSTONA Love.

(Lowe, Proc. Zoöl. Soc. Lond. 1843, 87: type Echiostoma barbatum Lowe.)

Body elongate, compressed, scaleless. Head rather compressed, the snout short and the cleft of the mouth very wide. Teeth pointed, unequal, those of the premaxillary and the front of the lower jaw being longest; maxillary teeth in a single series, those of the lower two-thirds being small; teeth of the hinder part of the mandible in a double or triple series; vomer with a pair of fangs; palatines with a single series of small pointed teeth; two groups of similar teeth on the tougue. Eye of moderate size. Opercular portion of the head very narrow and flexible; a fleshy barbel on the centre of the hyoid region. Dorsal fin far back, opposite anal. Candal forked. Vent not far in advance of caudal fin. Pectorals and ventrals feeble, the latter behind the middle of the body. Series of phosphorescent dots along the lower side of the head, body, and tail. Gill-openings very wide. Gill-rakers minute. No pseudobranchiæ. No air-bladder. Atlantic. (ἔχιζ, a viper; στόμα, mouth.)

### 478. E. barbattura Lowe.

Black, with an elongate, club-shaped (phosphorescent) rose-colored spot between the maxillary and the eye. Barbel as long as head (in specimens seen), fringed at its tip. "Upper ray of pectoral produced in a long and slender filament reaching nearly to the root of the ventrals" (wanting in specimens examined). Ventrals narrow, elongate. Head 6 in length; depth 9. B. 12; D. 12–15; A. 17; P. 3–5; V. 8. L. 9 inches. Deep waters of the Atlantic; lately taken off Gloucester, Mass.

(Lowe, Proc. Zoöl, Soc. Lond, 1843, 88; Günther, v. 427; Goode & Bean, Bull, Essex, Inst. 1879, 23.)

### 126.-MALACOSTEUS Ayres.

(Ayres, Journ. Bost. Soc. Nat. Hist. 1849, 53: type Malacosteus niger Ayres.)

Body elongate, compressed, scaleless. Head rather compressed, the snont very short, the eleft of the month very wide, extending to behind the root of the pectorals. Teeth pointed, unequal, in single series on both jaws and tongue; none on the palate. Opercula membranaceous. Dorsal far back, opposite anal. Pectorals rudimentary. Ventrals rather posterior. One species known. (μαλαχός, soft; ὀστένν, bone.)

### 472. M. niger Ayres.

Black, with a white loral spot. Snout very short, convex. Lower jaw with very long canines. Barbel long and slender. Pectoral rays coalescing into a thin, long filament. Ventrals filamentous. Head  $3\frac{3}{4}$  with caudal; depth 6. D. 19; A. 20; P. 5; V. 6. North Atlantic; a single specimen known. (Ayres.)

(Ayres, l. c.; Gunther, vi, 427.)

#### 137.-ASTRONESTHES Richardson.

(Richardson, Ichth. Voy. Sulph. 97, 1845: tyne Astronesthes nigra Rich.)

Body rather elongate, compressed, scaleless. Head compressed, the snout short, the mouth wide. Teeth pointed, unequal. Upper jaw with four long, curved canines; lower with two; maxillary teeth fine, subequal; palatines with a single series of small, pointed teeth, similar to those on tongue. Eye moderate. Throat with a barbel. Dorsal fin long, inserted in front of anal, behind ventrals; adipose fin present; caudal forked; paired fins well developed. Gill-rakers minute. No pseudobranchiæ. No air-bladder. Lower parts with phosphorescent spots. ( $\tilde{\alpha}\sigma\tau\rho\sigma\nu$ , star (star-fish);  $\varepsilon\sigma\theta\iota\omega$ , to eat.)

#### 473. A. niger Rich.

Black, with about 22 luminous spots between chin and ventrals. Barbel a little longer than head. Dorsal beginning just behind base of ventrals; pectoral not reaching nearly to ventrals. Jaws equal. Eye large, well forward. Head 4; depth 5½. D. 17; A. 14. Deep waters of the Atlantic; described from specimens from the Grand Banks, perhaps belonging to a different species.

(Richardson, Ichth. Voy. Sulph. 97; Günther, v. 425.)

# FAMILY XLVL—SALMONIDÆ.

(The Salmon Family.)

Body oblong or elongate, covered with cycloid scales. Head naked. Mouth terminal, varying much in size and form; maxillary forming the lateral margin of the upper jaw, provided with a supplemental bone; premaxillaries not protractile. Teeth various, sometimes wanting. Gills 4, a slit behind the fourth. Pseudobranchiæ present, but often small or rudimentary. Gill-rakers various. Gill-membranes not connected free from the isthmus. Branchiostegals 3-20. No barbels. Dorsal usually nearly median, not greatly elongate. Adipose fin present. Caudal fin forked. Anal fin moderate or rather long. Ventrals moderate, nearly median. Pectorals placed low. Lateral line present. Abdomen rounded. Air-bladder large. Stomach cocal or siphonal: the pyloric cœca few or many, sometimes obsolete. Ova generally large, falling into the cavity of the abdomen before exclusion. Genera about 20; species 125. A large and varied family; its members inhabit chiefly the fresh waters of northern regions, many of them being anadromous, running up from the sea to spawn in the rivers. One genus (Retropinna) is found in New Zealand, and the species of Microstoma, Argentina, and Hyphalonedrus are mostly deep-sea fishes. In economic importance this family ranks among the very first, and the salmon and trout in all northern regions are the choicest prizes of the angler.

(Salmonidæ Günther, vi, 1-205.)

- † Dorsal fin nearly over the ventrals. (Argentinina.)
  - a. Branchiostegals 3 or 4; body clongate, subcylindrical .... Microstoma, 138. aa. Branchiostegals 6-8; body compressed.
    - b. Adipose fin long and low, scarcely shorter than dorsal fin.

Mallotus (juv.)

- bb. Adipose fin normal, short and high.
  - c. Ventrals inserted in front of the middle of the dorsal; mouth large.

<sup>\*</sup> Pyloric cœca few or none; stomach cœcal.

- dd. Scales larger, similar in both sexes; pectoral rays 10-12.
  - e. Teeth feeble, those on tongue very weak; scales small, adherent.

Thaleichthys, 141.

- cc. Ventrals inserted under or behind the middle of dorsal; mouth moderate or small.
  - f. Scales cycloid.
    - g. Jaws with minute teeth; maxillary reaching past front of eye.

Hypomesus, 143.

qq. Jaws toothless; maxillary not reaching front of eye.

Argentina, 144.

ff. Scales ctenoid ...... Hyphalonedrus, 145.

\*\* Pyloric coca many; stomach siphonal,

#Jaws with distinct teeth; scales mostly small. (Salmoning.)

h. Dorsal fin very long and high, of about 20 rays; scales moderate; fongue toothless; not anadromous.

THYMALLUS, 147.

- hh. Dorsal fin moderate, its rays 9-15 in number; tongue with teeth.
  - Dentition very feeble, incomplete; anal fin elongate, of about 17 rays; scales moderate; not anadromous.

STENODUS, 148.

- ii. Dentition strong and complete; conical teeth on jaws, vomer, and palatines; tongue with two series of strong teeth (decidnous in very old specimens of Oncorhynchus); scales small.
  - Anal fin elongate, of 14-17 rays; vomer narrow, long, tlat, with weak teeth; species black spotted.

Oncorhynchus, 150.

- ij. Anal fin short, of 9-11 developed rays.
  - k. Vomer tlat, its toothed surface plane; teeth on the shaft of the vomer in alternating rows or in one zigzag row, those on the shaft placed directly on the surface of the bone, not on a free crest (posterior vomerine teeth sometimes deciduous); species black spotted....Salmo, 151.

#### 138 .- NICEOSTONA Cavier.

(Cuvier, Règne Anim. ii, 1817: type Gasteropelecus microstoma Risso=Microstoma rotumaatum Risso.)

Body elongate, cylindrical, covered with large, thin, silvery scales. Head short. Month very small, terminal; premaxillaries very small; maxillaries very short and broad, not extending to the front of the very large eye, which forms more than half the depth of the side of the head. Lower jaw and vomer with a narrow series of fine teeth; no other teeth. Dorsal fin short, inserted before or behind the ventrals, which are behind Bull. Nat. Mus. No. 16——19

### 474. M. grænlandicum Reinh.

"This fish appears to be intermediate between Argentina and Microstoma, having the dorsal fin inserted for the greater part in advance of the ventrals, and a series of fine teeth in the lower jaw. Teeth on the vomer, none on the tongue. Adipose fin conspicuous. The height of the body is one-half the length of the head and one-tenth of the total." B. 3; D. 11; A. 10; V. 10. (Günther.) Greenland.

(Microstomus grönlandicus Reinh, Vidensk, Selsk, Naturv, Mathem, Afhandl, viii, 1841, lxxiv; Günther, vi, 205.)

### 139.-MALLOTUS\* Cuvier (young).

Form and dentition of *Thaleichthys*. No trace of scales in the known examples, which are immature. Dorsal fin well backward over ventrals, its insertion nearer the tip of the caudal than the snout; adipose fin long and low, its height much less than the length of its base, its base little shorter than that of the dorsal; pectoral rays in increased number; anal moderate. Pseudobranchiae well developed. Branchiostegals 9. Pyloric cœea 4.

## 473. M. villosus (Müller) Cuvier (young).

Translucent whitish; a silvery lateral stripe; upper regions closely punctate. Eye a little shorter than snout, 4 in head. Minute teeth in both jaws; middle of tongue rough; maxillary reaching front of pupil. Ventrals and pectorals about equal in length to the longest dorsal ray, which is 7 times in length of body; ventrals inserted below first ray of dorsal, not reaching vent; space between dorsal and adipose fin two-thirds length of head; length of adipose fin more than twice its height, two-thirds base of anal. Head 4; depth 6. D. 12; A. 21; V. 8; P. 16. L. 4 inches. Behring's Straits. Probably developed scales when adult.

<sup>\*</sup>As these pages are passing through the press, we learn from Dr. Bean that the fish here described, collected by him in Behring's Straits, is not a distinct genus and species as at first supposed, but the young of *Mullotus villosus*. We therefore suppress the proposed generic and specific names, letting the description remain, it being too late to cancel the latter.

#### 140 .- MALLO'PHS Cuvier.

### Capelius.

(Cuvier, Règne Anim. 1829, ed. 2, ii: type Clupca villosa Miiller.)

Body clongate, compressed, covered with minute scales, a band of which, above the lateral line and along each side of the belly, are enlarged, and in mature males they become elongate-lanceolate, densely imbricated, with free, projecting points, forming villous bands. In very old males the scales of the back and belly are similarly modified, and the top of the head and the rays of the paired fins are finely granulated. Mouth rather large, the maxillary thin, extending to below the middle of the large eye. Teeth minute, forming single series on the jaws, vomer, palatines, and pterygoids: lingual teeth somewhat enlarged, in an elliptical patch. Lower jaw projecting. Dorsal inserted over ventrals. Branchiostegals 8-10. Lower fins very large. Pectoral fins large, horizontal, with very broad base, their rays in increased number (16-20). Pseudobranchiæ quite small. Gill-rakers long, slen-Ova very small. Marine species of the Pyloric cœca 6, small. North Atlantic and Pacific. (μαλλωτός, villous.)

### 476. M. villosus (Müller) Cuvier.—Capelin.

Dusky olivaceous above, grayish silvery on sides and below. Head long, pointed. Base of anal in males compressed and prominent; pectorals reaching more than half way to ventrals, the latter to anal. Eye large, 3½ in head. Head 4½ in length; depth about 6. D. 12; A. 18. Lat. l. ca. 150. Greenland to Cape Cod and Alaska; abundant northward.

(Clupca villosa Müller, Prodr. Zoöl. Dan. 1777, 245; Günther, vi, 170.)

### 141.—THALESCHTHYS Girard.

# Eulachon.

(Girard, U. S. Pac. R. R. Surv. Fish. 1859, 325: type Thaleichthys stevensi Grd. = Salmo pacificus Rich.)

This genus is intermediate between *Mallotus* and *Osmerus*, differing from the latter in its rudimentary dentition. All the teeth are very feeble, slender, and deciduous, although occasionally present on all the bones of the mouth. No permanent teeth on the tongue. The scales are much smaller than in *Osmerus*, and more closely adherent; larger than in *Mallotus*, and similar in the two sexes. The coloration is dusky.

Small fishes of the North Pacific, remarkable for their extreme oiliness. When dried they burn like a candle. (θάλεια, rich; ἐχθὸς, fish.)

## 477. T. pacificus (Rich.) Grd.—Lulachon; Candle-fish.

Color white, scarcely silvery; upper regions rendered dark iron-gray by the accumulation of dark punctulations. Body rather elongate, slender, and less compressed than in Osmerus. Head long, blunter than in Hypomesus pretiosus, less compressed, broader, and more convex above. Month large, the maxillary rather narrow and long, reaching beyond the middle of the rather small eye; lower jaw projecting. Opercle with strong concentric striae. Gill-rakers numerous, rather long and slender. Ventrals large, inserted just in front of dorsal. Pseudobrauchiae small. Head  $4^{a}_{4}$ ; depth 6. B. 8; D. 11; A. 21; P. 11. Lat. l. 75; pyloric cocca 11; vertebrae 70. L. 12 inches. Oregon to Alaska, ascending the rivers in enormous numbers in the spring. An excellent pan-fish, unsurpassed in delicacy of flesh.

(Salmo (Mallotus?) pacificus Richardson, Fauna Bor.-Amer. iii, 226: Thaleichthys stevensi Girard, U. S.Pac. R. R. Surv. Fish. 325; Günther, vi, 168.)

#### 112.-OSMERUS Linnieus

#### Smelts.

(Artedi; Linnæus, Syst. Nat.: type Salmo eperlanus L.)

Body clongate, compressed. Head long, pointed. Mouth wide, the slender maxillary extending to past the middle of the eye; lower jaw projecting. Preorbital and suborbital bones narrow. Maxillaries and premaxillaries with fine teeth; lower jaw with small teeth, which are larger posteriorly; tongue with a few strong, fang like teeth, largest at the tip; hyoid bone, vomer, palatines, and pterygoids with wide-set teeth. Gill-rakers long and slender. Branchiostegals 8. Scales large, loose, 60–70 in the course of the lateral line. Dorsal small, about midway of the body, over the ventrals; anal rather long. Vertebræ about 60. Pyloric cœca small, few. Small fishes of the coasts of Europe and Northern America, sometimes ascending rivers. They are considerably valued as food. (ôσχηρός, odorous; the name is equivalent to the English 4 smelt".)

a. Vomer with a cross-series of small teeth; species spawning in the sea.

#### 478. O. thalcichthys Ayres.

Olivaceous, sides silvery and somewhat translucent. Body comparatively deep and compressed. Head rather short and deep, the maxil-

lary broad, its edge strongly curved, extending to opposite posterior margin of pupil. Premaxillary on the level of upper part of pupil. Mandible projecting, its tip somewhat curved upward. Eye longer than snout, 4 in head. Fins high, the pectorals usually reaching ventrals, and the ventrals to anal; anal reaching about to caudal. Teeth weak; maxillary teeth scarcely visible. Head 4½; depth 5½. D. 9; A. 18; P. 11. Lat. l. 60. L. 9 inches. Pacific coast from San Francisco northward; rather common.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 62; Günther, vi. 168.)

### 479. O. attenuatus Lockington.

Greenish, sides silvery. Body elongate, compressed. Head rather long, somewhat pointed; maxillary extending past pupil; lower jaw projecting; maxillary rather narrow, little convex. Outline of both jaws nearly straight, less curved than in O. thaleichthys. Teeth on tongue strong, but much smaller than in O. mordax; teeth on maxillary conspicuous; front of both jaws with rather strong teeth; palatine teeth variable, usually strong. Eye large, 4 in head. Fins low. Pectorals not reaching ventrals, nor ventrals anal, nor anal to caudal. Head  $4\frac{1}{5}$ ; depth 6. D. 10; A. 15-17; P. 11. Lat. l. 65. L. 10 inches. Coast of California; not rare. Very close to O. thaleichthys, but probably distinct.

(Lockington, Proc. U. S. Nat. Mns. 1880, 66.)

aa. Vomer with 2-4 strong fang-like teeth; species ascending rivers.

### 480. O. mordax (Mitch.) Gill.—American Smelt.

Transparent greenish above, silvery on sides; body and fins with some dark punctulations. Body rather long and slender. Head large, with large mouth and stronger teeth than in the other species of the genus. Small teeth along the edge of the maxillary; strong fang-like teeth on tongue and front of vomer; cardiform teeth on palatines, pterygoids, and hyoid bone; mandible with moderate teeth, its tip projecting. Scales decidnous. Dorsal fin rather posterior, the ventrals under its front. Lower fins moderate, none reaching the next behind it. Gillrakers two-thirds diameter of eye. Head 4; depth 6½. D. 10; A. 15; P. 13. Lat. l. 68. L. 12 inches. Atlantic coast from Virginia northward, entering streams and often land-locked. Very close to the European O. eperlanus, but the latter has larger scales (Lat. l. 60), shorter gill-rakers, and rather weaker teeth.

(Atherina mordax Mitchill, Trans. Lit. & Phil. Soc. N. Y. 1814, 446: Osmerus viridescens Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 230: Osmerus viridescens Gün(her, vi, 167.)

Var. spectrum Cope.-Wilton Smelt.

Slender. Head short, with very large eye, and short mouth and maxillary. Maxillary not extending beyond middle of pupil. Eye 3 in head. Read  $4_4^4$ ; depth  $8_3^4$ . D. 10; A. 15; Lat. l. 66. L. transv. 10. Small. Wilton Pond, Kennebec County, Maine; land-locked in fresh water. (*Cope.*)

(Osmerus spectrum Cope, Proc. Amer. Phil. Soc. Phila, 1870, 490.)

Var. abbotti Cope.—Cobessicontic Smelt.

Stouter. Eye smaller. Maxillary reaching posterior margin of pupil. Eye  $4\frac{1}{2}$  in head. Head  $4\frac{3}{4}$ ; depth 7. Lat. 1. 68. L. transv. 16. Land-locked in Cobessicontic Lake, Kennebec County, Maine. (*Cope.*)

(Osmerus abbotti Cope, Proc. Amer. Phil. Soc. Phila. 1870, 490.)

### 481. O. dentex Steindachner.

Dark brown above; sides silvery or golden; head and body with dark points. Eye two-thirds length of snont. Teeth as in *O. eperlanus* and *O. mordax*; maxillary reaching posterior margin of eye, its length five times in distance from tip of lower jaw to dorsal. Height of dorsal half length of head; height of anal two-sevenths. Head 4; depth 5½. D. 10; A. 13; V. 8; Lat. l. 66; L. transv. 16. Port Clarence, Alaska, to northern China. (*Bean*, MSS.)

(Steindachner, Sitzungsb. Kais. Akad. Wiss. Wien, lxi, 1870, 429.)

#### 143.—HYPOMESUS Gill.

## Surf Smelts.

(Gill, Proc. Acad. Nat. Sci. Phila, 1832, 169: type Argentina pretiosa Grd.)

Body rather elongate, moderately compressed, covered with thin scales of moderate size. Head rather pointed. Mouth moderate, formed as in Argyrosomus, the shortish maxillary not extending quite to middle of eye; its outline below broadly convex, lower jaw projecting. Teeth minute, on jaws, vomer, palatines, pterygoids and tongue. Ventrals inserted directly under middle of dorsal, midway between eye and base of caudal. Branchiostegals 6–7. North Pacific. ( $\delta\pi\delta$ , below;  $\mu\xi\sigma\sigma_5$ , middle; in allusion to the position of the ventrals.)

### 482. II. pretiosus (Grd.) Gill.—Surf Smelt.

Light olivaceous; a silvery band along the lateral line. Eye as long as snout, 4½ in head. Fins low, the longest dorsal ray 8 in length, without caudal; pectorals searcely reaching half way to ventrals, 7

in length of body; ventrals not reaching vent, their length 8½ in body. Head 4½; depth 4½. D. 10; A. 15; P. 14; V. 8; Lat. l. 70. L. 12 inches. Pacific coast, from California northward; abundant, spawning in the surf. A very firm-fleshed and fat little fish, searcely inferior to the calachon.

(Argentina pretiosa Grd. Proc. Acad. Nat. Sci. Phila, 1854, 155; Osmerus pretiosus Girard, U. S. Pac. R. R. Surv. Fish. 324; Osmerus clongatus Ayres, Proc. Acad. Nat. Sci. Phila, 1854, 17.)

## 483. H. olidus (Pallas) Günther.

Darker. Fins higher, the longest dorsal ray 6 in length of body; pectorals reaching two-thirds the distance to root of ventrals, their length 5 in body; ventrals 6 in length of body. Lat. I. 56-60. Alaska and Kamtschatka, spawning in fresh-water ponds. (*Bean*, MSS.)

(Salmo (Osmerus) olidus Pallas, Zoogr. Ross. As. iii, 391; Günther, vi, 169, in part.)

#### 141.-ARGENTINA Linueus.

### Argentines.

(Artedi; Linnaus, Syst. Nat.: type Argentina sphyrana L.)

Body oblong, covered with rather large cycloid scales, which are often rough with spinous points. Mouth small, the maxillaries very short, not reaching to the eye. Eye very large. Jaws toothless; an arched series of minute teeth on the head of the vomer and on the fore part of the palatine; tongue typically, with a series of small curved teeth on each side. Dorsal fin short, in advance of the ventrals. Caudal fin deeply forked. Eggs small. Fishes of the deep waters of the North Atlantic and Mediterranean, never entering fresh waters. (Latin argentum, silver.)

## 484. A. syrtersitra Goode & Bean.

Body compressed. Head not quite twice as long as deep. Snout nearly 3½ in head. Insertion of dorsal midway between snout and adipose fin; ventrals under last ray of dorsal. Scales very large, cycloid, covered with minute asperities; a median row of scales along the back and the beliy. Color olivaceous; sides silvery. Head 4½; depth 5½. B. 6; D. 12; A. 43; V. 14; scales 3–60–4. L. 17 inches. Sable Island Bank, in deep water.

(Goode & Bean, Proc. U. S. Nat. Mus. 1878, 261.)

<sup>\*</sup>Scales more or less rough. (Silus Reinhardt.\*)

<sup>\*</sup> Reinhardt, Bemärkn, til den Skand, Ichthyol, 11: 1ype Salmo silus Ascanius, (From the Norwegian name Vas-Sil, said to mean rough herring.)

#### #A5. - SEVERSANONESDEREIS Goode

(Goode, Proc. U. S. Nat. Mus. 1850, iii, 483; type II. chalubeius Goode.)

Body sub-terete, covered with adherent rough-pectinate or etenoid scales. Mouth rather large, the maxillary reaching to beyond front of orbit; lower jaw projecting. Teetin on jaws, small, sharp; tongue smooth. Dorsal in front of ventrals. Otherwise essentially as in Argentina.. Deep sea. ( $\Im \varphi a \lambda \sigma z$ , under the sea;  $\Im z \Im \varphi \sigma z$ , dweller.)

### 485. II. chalvbeins Goode.

Grayish, mottled with brown; scales metallic silvery. Body plump, terete. Maxillary broad and flattened posteriorly, extending to front of papil, its length 2\frac{3}{4} in head. Interorbital space broad, 4 times the diameter of eye. Scales arranged in regular transverse rows, overlapping in such a manner as to resemble oblique plates on the sides. Lateral line prominent, straight. Insertion of dorsal midway between pectorals and ventrals, or snont and adipose fin; pectorals long; ventrals under middle of dorsal; caudal forked. Head 4; depth 4. D. 11; A. 8; P. 17 or 18; V. 9 or 10; Lat. l. 52. Deep sea, off the coast of Rhode Island.

(Goode, Proc. U. S. Nat. Mus. 1880, 484.)

## 146.—COREGONUS Linnaus.

## White-fish.

(Artedi; Linniaus, Syst. Nat.: type Coregonus laveretus L.)

Body oblong or elongate, compressed. Head more or less conic, compressed, the form of the snout varying considerably. Month small, the maxillary short, not extending beyond the orbit, with a well-developed supplemental bone. Teeth extremely minute, if present. Scales moderate, thin, cycloid, rather firm. Dorsal fin moderate; caudal fin deeply forked; anal fin somewhat elongate; ventrals well developed. Pseudobranchia large. Gill-rakers varying from short and thickish to very long and slender. Air-bladder very large. Stomach horseshoe-shaped, with many (about 100) pyloric ceca. Ova small. Species about 40, inhabiting the clear lakes of Northern Europe, Asia, and America, in Arctic regions descending to the sea. Most of them spawn in late fall or winter near the shore, at other seasons often frequenting considerable depths. The group, as here defined, includes a number of sections characterized by minor modifications of structure, some of which have been considered as genera. It seems to us that the number of distinct species has been overestimated by previous writers, and that the geographical range of each one is much wider than has hitherto been

generally supposed. The species are highly valued for food, the flesh being generally pale and of fine flavor. The coloration is very uniform; bluish olivaceous above; the sides and below silvery.  $(z\delta\dot{\rho}\dot{\rho}\dot{\tau}_{i},$  the temples;  $\gamma\dot{\omega}_{zoz}$ , angle.)

This genus may be subdivided as follows:

- \* Lower jaw included; premaxillaries broad, placed vertically or the lower edge turned inward.
  - tGill-rakers short, thickish, few in number; preorbital broad, wider than pupil; maxillary short and rather broad, not reaching to the line of the eye; the small supplementary bone mostly narrow and sharply elliptical; month very small (Prosofium Milner).....conesi, williamsoni, quadrilateralis, kennicotti.
  - ttGill-rakers numerous, long, and slender; preorbital long and narrow; maxillary comparatively long, the supplemental bone ovate. (Coregonus.)

    - ## Tongne with about three series of small teeth; body clongate, compressed.
      - labradoricus.
- - - §§ Body short, deep, compressed, shad-like; curve of the back similar to that of the belly; scales large, larger forwards, rather closely imbricated, the posterior margin little convex (Allosomus Jordan) ......tullibee.
- \*Lower jaw included; premaxillaries broad, placed vertically or turned inward.
  - †Gill-rakers short, thickish, few in number; preorbital broad, wider than pupil; maxillary short and rather broad, not reaching to the line of the eye; the small supplementary bone mostly narrow and sharply elliptical; month very small. (Prosopium\* Milner.)

### 486. C. couesi Milner .- Chief Mountain White-fish.

Head narrowed anteriorly, the snout prolonged, pig-like, protruding beyond the mouth. Maxillary 4 in head, barely reaching eye. Suborbital and supraorbital wider than in the other species. Depth  $4\frac{1}{5}$  in length; length of head about the same; body therefore elongate, not elevated nor much compressed. D. 12; A. 10; scales 8-88-7. Chief Mountain Lake, Montana, a tributary of the Saskatchawan. Very close to the next, if really different; the head and mouth larger in the single specimen known.

(Milner, Rept. U. S. Fish Com. 1872-73, 88: Prosopium couesi Milner, in Jordan, Man. Vert. ed. 2, 362.)

## 487. C. Williamsoni Girard.—Rocky Mountain White-fish.

Body oblong, rather deeper than in *C. quadrilateralis*, but little compressed. Head shortish, conic, the profile more abruptly decurved than in the others. Snout compressed and somewhat pointed at tip, which is entirely below the level of the eye. Maxillary short and very

<sup>\*</sup> Milner, in Jordan Man. Vert. ed. 2, 351: type C. quadrilateralis Rich. (προσωπείον, a mask; from the broad preorbital.)

broad, reaching just about to the anterior margin of eye; therefore, apparently longer than in the next, owing to the shortness of the shout. Maxillary contained 4 times in the length of the head; mandible 3 times. Month inferior. Eye  $4\frac{2}{3}$  in head. Adipose fin very large, extending behind anal. Depth  $4\frac{1}{4}$  in length; head  $4\frac{2}{3}$ . D. 11-14; A. 11; scales 8-74 to 88-7. Gill-rakers short and thick, shorter than pupil; about 16 below the angle. Clear streams and lakes from the Rocky Mountains to the Pacific; abundant in the Sierra Nevada. An excellent food-fish; variable.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 133; Günther, vi, 187.)

488. C. quadrilateralis Richardson.—Pilot-fish; Menomonee White-fish; Shad Waiter; Round-fish.

Body elongate, not elevated nor much compressed, the back rather broad, the form more terete than in any of the other species. Mouth very small and narrow, inferior, the broad maxillary not reaching to opposite the eye,  $5\frac{1}{2}$  in head. Head long, the snout compressed and bluntly pointed, its tip not below level of eye; profile not strongly decurved. Preorbital wider than pupil. Mandible originating under middle of eye,  $3\frac{1}{3}$  in head. Adipose fin small. Gill-rakers short and stoutish, but rather longer than in *C. williamsoni*. Head 5 in length; depth  $4\frac{3}{4}$ . D. 11; A. 10; scales 9–80 to 99–8. Color dark bluish above, silvery below. Lakes of New Hampshire, Upper Great Lakes, northwestward to Alaska; abundant in cold, deep waters.

(Richardson, Franklin's John. 1823, 714; Günther, vi, 176: Coregonus novæ-angliæ Prescott, Amer. John. Sci. Arts xi, 342, 1851: Coregonus novæ-angliæ Günther, vi, 186.)

## 489. C. Kemmicotti Milner, MSS. sp. nov.

Body oblong, elliptical, the back not greatly elevated. Head very short and deep, the snout bluntly decurved and not projecting, the depth of the head at the nape greater than the distance from the end of the snout to the opercular margin. Mouth not inferior, the jaws almost equal; maxillary extremely short and broad, not quite reaching to the eye, its length  $5\frac{1}{6}$  in head, its supplemental bone broad-ovate, broader than in clupciformis. Gill-rakers as in C. quadrilateralis. Preorbital rather broad. Color pale, as in clupciformis. Head  $5\frac{1}{4}$  in length. D. 11; A. 13; scales 10–90–10. Types Nos. 8971 and 9600 of the United States National Museum from Fort Good Hope, British America, and Yucon River, Alaska, respectively. A strongly marked species, well distinguished among the American forms by the very obtuse head, but perhaps identical with some Siberian species.

tt Gill-rakers numerous, long and slender; preorbital long and narrow; maxillaries comparatively long; the supplemental bone ovate, rather broad. (Coregonus.) 
‡ Tongue toothless, or nearly so: back elevated.

### 490. C. clapeiformis (Mitch.) Milner.—Common White-fish.

Body oblong, compressed, always more or less elevated, and becoming notably so in the adult. Head comparatively small and short, the snout bluntish, obliquely truncated; tip of snout on level of lower edge of pupil; width of preorbital less than half that of pupil. Maxillary reaching past front of orbit, about 4 in head. Eye large, 4–5 in head. Gill-rakers moderate,  $\frac{2}{3}$  diameter of eye, about 20 below the angle. Color olivaceous above; sides white, but not silvery; lower fins sometimes dusky. Head 5; depth 3–4. D. 11; A. 11; scales 8–74–9. L. 20 inches. Great Lakes and northward; the best known and most highly valued of the American white-fishes. This species, like others of wide distribution, is subject to considerable variations, dependent on food, waters, etc. Feeds on minute organisms.

(Salmo clupviformis Mitchill, Amer. Month. Mag. ii, 321, 1818: Coregonus albus Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 231, 1818: Coregonus albus Giinther, vi, 184, and of authors generally: Coregonus richardsoni Giinther, vi, 185: Coregonus sapidissimus Giinther, vi, 186: Coregonus latior Gunther, vi, 186: Coregonus olsego, the "Otsego Lake Bass", DeWitt Clinton Med. & Phil. Register, iii, 188.)

# Tongue with about three series of small teeth; body elongate, compressed.

### 491. C. labradoricus Rich .- "Whiting"; Musquaw River White fish.

Body rather elongate, compressed, the back not elevated. Head rather long and slender, compressed. Month rather small, the jaws equal, the maxillary reaching to the front of the pupil. Maxillary bone broad, rather short, its supplementary piece ovate. Mandible reaching middle of eye. Eye large,  $4_3^{\circ}$  in head. Supraorbital bone narrow. Gill-rakers rather long. Bluish black above, silvery below; scales with dark punctulations; fins all dusky. Dorsal fin high in front, the last rays short. Head  $4_3^{\circ}$ ; depth  $4_3^{\circ}$ . D. 11; A. 11; scales 9–80–8. L. 12 inches. Great Lake region to the lakes of the Adirondacks and White Mountains, and northeastward; generally abundant in cold, clear lakes.

(Ri hardson, Fauna Bor.-Amer. iii, 203, 1836; Günther, vi, 176: Coregonus nechantonicusis Prescott, Amer. Journ. Sci. Arts, xi, 342, 1851.)

### Tongue nearly toothless; back not elevated.

### 492. C. hoyi (Gill) Jordan.—Lake Moon-eye; Cisco of Lake Michigan.

Body rather elongate, compressed, the back somewhat elevated. Head rather long, in form intermediate between *Coregonus* and *Argyro-*

somus. Mouth rather large, terminal, the lower jaw evidently shorter than upper, even when the mouth is open; tip of muzzle rather bluntly truncate; maxillary reaching to opposite middle of pupil, about 3 in head; mandible extending to posterior margin of pupil. Supraorbital and preorbital narrow. Eye very large, 3½ in head. Tongue with traces of teeth. Gill-rakers slender, about 25 below the angle, rather long, nearly as long as eye. Pseudobranchiæ very large. Fins low; free margin of dorsal very oblique. Color bluish above, sides and below rich silvery, brighter than in any other of our Coregoni, much as in Hyodon and Albula. Lateral line almost straight. Head 4½; depth 4¾. D. 10; A. 10; scales 7-75-7. L. 12 inches. Deep waters of Lake Michigan, Lake Ontario, and neighboring lakes; the smallest and handsomest of our Coregoni. It is intermediate in its relations between the typical Coregoni and Argyrosomus.

(Argyrosomus hoyi (Gill, MSS.) Milner, Rept. U. S. Fish Com. 1872-73, 86, 1874; Jordan, Man. Vert. ed. 2, 275.)

\*\*Lower jaw projecting; premaxillaries narrow, placed more or less horizontally. § Body elongate, subtasiform; scales small, uniform, convex behind. (Argyrosomus Agassiz.\*)

#### 493. C. merki Gthr.

Steel-bluish above, with many dark points; belly white; dorsal and caudal mostly blackish; pectorals and ventrals tipped with black; eye blackish, the iris silvery. Body rather elongate, compressed. Form of mouth as in C. artedi, the lower jaw considerably projecting; maxillary broad, with rather broad supplemental bone, three times as long as wide, extending to middle of the very large eye, its length 3 in head; preorbital extremely narrow. Length of mandible somewhat more than least depth of tail. Teeth none, or reduced to minute asperities on the tongue. Gill-rakers numerous, very long and slender. Dorsal very high, much higher than long, its last rays rapidly shortened, the first rays twice the length of base of fin; insertion of dorsal midway between snout and middle of adipose fin. Caudal large, well forked; anal small; ventral inserted under middle of dorsal, very long, 5 length of head; pectoral the same length. Scales as in C. artedi. Head 5; depth 53. Eye 3 in head. D. 11; A. 14; V. 11; scales 7-80-8. Behring's Sea to the north shore of Siberia, ascending rivers; lately obtained by Dr. Bean in Alaska.

(Salmo clupeoides Pallas, Zoogr. Ross. Asiat. iii, 410; not Coregonus clupeoides Lacépède; Günther, vi, 195.)

<sup>\*</sup>Agassiz, Lake Superior, 150, 339: type Coregonus clapeiformis DeKay, not of Mitchill,=Coregonus artedi Le Sueur. (αργυρος, silver; σῶμα, body.)

## 491. C. artedi Le Suenr.—Lake Herring; Cisco; Michigan Herring.

Body elongate, compressed, not elevated. Head compressed, rather pointed. Month rather large, the maxillary reaching about to the middle of the pupil, about 3½ in head; the mandible 2¼ in head. Preorbital bone long and slender; suborbital broad; supraorbital nearly as long as eye, about 4 times as long as broad. Eye 4-5 in head. Gill-rakers very long and slender, as in Clupea, as long as eye, 25-30 below the angle. Bluish black or greenish above; sides silvery; scales with dark specks. Fins mostly pale, the lower dusky tinged. Head 4½; depth 4½. D. 10; A. 12; scales 8-75 to 90-7. L. 12 inches. Great Lakes and northward to Alaska and Labrador; very abundant, usually frequenting shallow waters. In numerous small lakes in Indiana and Wisconsin (Geneva, Tippecanoe, Oconomowoc, etc.) is the modified var. sisco (Argyrosomus sisco Jordan, Amer. Nat. 1875, 136), which lives in the deep waters, coming into shallower waters to spawn in December.

(Coregonus artedi Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 231, 1818: Coregonus ctupei-formis Günther, vi, 198, and of nearly all authors, but not Salmo clupeiformis of Mitchill: Salmo (Coregonus) harengus Richardson, Fanna Bor.-Amer. iii, 210: Salmo (Coregonus) lucidus Richardson, Fanna Bor.-Amer. iii, 207: Coregonus lucidus Günther, vi, 198: Coregonus harengus Günther, vi, 199.)

## 495. C. migripinmis (Gill) Jor.—Blue-fin; Black-fin.

Body stout, fusiform, compressed. Head stout. Mouth large, the lower jaw projecting. Eye rather large, longer than snout, about 4 in head. Teeth very minute, but appreciable on premaxillaries and tongue. Gill-rakers very numerous, long and slender. Color dark bluish above: sides silvery, with dark punctulations; fins all blueblack. Head 4½; depth 3¾. D. 10; A. 12; scales 9–88–7. L. 18 inches. Deep waters of Lake Michigan; locally abundant. Larger than most of the other *Coregoni*. Known at once by the black fins.

(Argyrosomus nigripinnis (Gill, MSS.) Milner, Rept. U. S. Fish Com. 1872-73, 87, 1875; Jordan, Man. Vert. 275.)

§§ Body short, deep, compressed, shad-like; curve of the back similar to that of the belly; scales large; notably larger forwards, rather closely imbricated, the posterior margin little convex. (Allosomus Jordan.\*)

## 496. C. tuillibee Rich.—Tullibee; "Mongrel While Fish".

Body short, deep, compressed, shad-like, the dorsal and ventral curves similar. Caudal pedancle short and deep. Head conic, compressed, much as in *C. nigripinnis*. Mouth large, the maxillary as long

<sup>\*</sup>Jordan, Man. Vert. ed. 2, 1878, 351: type Coregonus tullibee Rich. (ἄλλος, other, different; σωμα, body.)

as the eye, extending past the front of the pupil, its supplemental bone narrowly ovate, with prolonged point; jaws equal when closed. Eye large, as long as snout,  $4\frac{1}{2}$  in head. Preorbital narrow; supraorbital elongate, rectangular. Scales anteriorly considerably enlarged, their diameter half larger than the diameter of those on the caudal peduncle. Color bluish above; sides white, punetate with fine dots; each scale with a silvery area, these forming a series of distinct longitudinal stripes. Head 4; depth 3. D. 11; A. 11; scales 8-74-7. L. 18 inches. Great Lakes and northward. A handsome and well-marked species.

(Salmo (Coregonus) tullibee Rich. Fauna Bor.-Amer. iii, 201, 1835; Günther, vi, 199: Argyrosomus tullibee Jordan, Man. Vert. 361.)

#### 147.—THEW MARLES Cuvier.

# Graylings.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type Salmo thymallus L.)

Body oblong, compressed, little elevated. Head rather short. Mouth moderate, terminal, the short maxillary extending past the middle of the large eye, but not to its posterior margin. Teeth slender and sparse on the maxillaries, premaxillaries, and lower jaw; vomer short, with a small patch of teeth; teeth on the palatines; tongue toothless, or nearly so. Gill-openings wide. Branchiostegals 7 or 8. Gill-rakers short and rather stiff. Suborbital and preorbital bones narrow. Scales small and loose, 75–100 in the course of the lateral line. Dorsal fin very long and high, mostly in advance of the ventrals, of about 20 rays; adipose fin small; caudal fin forked; anal fin small, of 10–15 rays. Coloration brilliant, the dorsal with red or blue spots. Pseudobranchiæ well developed. Air-bladder very large. Pyloric appendages about 15. Beautiful fishes of the fresh waters of northern regions. (θύμαλλος, the Greek name of the Grayling, the fish having the odor of thyme—θύμος.)

### 497. T. sigmifer Richardson.—American Grayling.

Body elongate, compressed, highest under the anterior portion of the dorsal. Head rather short, subconic, compressed, its upper outline continuous with anterior curve of the back. Mouth moderate, the maxillary extending to below the middle of the eye; jaws about equal. Tongue, in the young, with teeth which are usually absent in the adult. Eye quite large, about 3 in head, rather longer than snout, about equal to the interorbital space. Scales moderate, easily detached. Lateral

line nearly straight. A small bare space behind isthmus. Dorsal fin long and high, its length rather greater than the depth of body, its height varying, greatest in the males: adipose fin rather small: anal fin small. Gill-rakers slender, short, about 11 below the angle. Coloration brilliant, (in var. tricolor) purplish gray; young silvery; sides of head with bright bluish and bronze reflections; sides of body with small, black, irregular spots, most numerous posteriorly in young specimens; ventral fins ornate, dusky, with diagonal rose-colored lines; dorsal with a black line along its base, then a rose-colored one, then a blackish one, then rose-colored, blackish, and rose-colored, the last stripe continued as a row of spots; above these is a row of dusky-green spots, then a row of minute rose-colored spots, then a broad dusky area, the middle part of the fin tipped with rose; anal and adipose fins dusky: central rays of caudal pink, outer rays dusky. Head 43; depth 43. D. 20; A. 11; scales 8-90-9. L. 18 inches. Northern Michigan to Montana, northward to Alaska and the Arctic Ocean; abounding in clear, cold streams in suitable locations. Professor Milner (Rept. U. S. Fish Com. 1872–73, 740, et seq.) recognizes three distinct species, which seem to us rather as varieties of one species. These are—

### Var. signifer Rich.

From British America and Alaska. Has the scales smaller, (Lat. l. 98), the maxillary shorter, and the head rather less than one-fifth the length; the dorsal rays are perhaps more numerous, and the fin in the males much higher.

(Coregonus signifer Rich. Franklin's Journ. 1823, 711: Salmo (Thymallus) signifer Rich. Fauna Bor.-Amer. iii, 190; Günther, vi, 202; Milner, Rept. U. S. Fish Com. 1872-73, 738.)

#### Var. tricolor Cope.—Michigan Grayling.

From various streams in the northern part of the southern peninsula of Michigan. Has a longer head than the preceding, forming a little more than one-fifth the length, and the scales larger, 90–92 in the lateral line.

(Thymallus tricolor Cope, Proc. Acad. Nat. Sci. Phila. 1865, 80: Thymallus tricolor Günther, vi, 201: Thymallus tricolor Milner, Rept. U. S. Fish. Com. 1872-73, 739, and of late writers on angling generally.)

### Var. montanus Milner.—Montana Grayling.

From the headwaters of the Missouri. Similar to tricolor, but has the body deeper, the depth being about 45 in the length.

(Thymallus montanus Milner, Rept. U. S. Fish Com. 1872-'73, 741, 1874.)

#### 148.—STENODUS Richardson

#### Tuconnue

(Luciotrutta Günther.)

(Richardson: type Salmo mackenzii Rich.)

Body rather elongate, little compressed. Head long, the cleft of the mouth wide. Maxillary long, broad, lanceolate, extending far backward, lower jaw projecting much beyond the upper. Dentition very feeble, the teeth extremely small; maxillary toothless; vomer, palatines, and tongue with narrow bands of minute villiform teeth. Gill-rakers rigid, awl-shaped, rough interiorly. Branchiostegals 10. Pyloric cœca in great number. Dorsal fin moderate, over ventrals; anal rather long; candal forked. Scales moderate. Coloration silvery. Migratory trout of large size, inhabiting the streams of Arctic America and Asia. ( $\sigma \epsilon \pm v \sigma z$ , narrow;  $\phi \delta a \phi b z$ , tooth.)

### 498. S. muckenzii Richardson.—Inconnu.

Body elongate, subterete. Head long and compressed, with flattened vertex. Eye moderate. Preopercle much curved. Dorsal fin nearer caudal than snout. Bluish above; sides silvery, as in the *Coregoni*. Head 3½. B. 10; D. 13; A. 15; scales 11–106–10. Mackenzie's River and its tributaries.

(Salmo weckenzii Richardson, Franklin's Journ. 1823, 707: Luciotrutta mackenziei Günther, vi. 164.)

### 149.-ONCOMENENCIUS Suckley.

## Pacific Salmons.

(Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 312: type Salmo scouleri Rich.)

Body elongate, subfusiform or compressed. Month wide, the maxillary long, lanceolate, usually extending beyond the eye; jaws with moderate teeth, which become in the adult male enormously enlarged in front. Vomer long and narrow, flat, with a series of teeth both on the head and the shaft, the latter series comparatively short and weak; palatines with a series of teeth; tongue with a marginal series on each side; teeth on vomer and tongue often lost with age; no teeth on the hyoid bone. Branchiostegals more or less increased in number. Scales moderate or small. Dorsal fin moderate; anal fin comparatively elongate, of 14-20 rays. Pyloric appendages in increased number. Gillrakers rather numerous. Ova large. Sexual peculiarities very strongly developed; the snout in the adult males in summer and fall greatly distorted; the premaxillaries prolonged, hooking over the lower jaw, which in turn is greatly elongate and somewhat hooked at tip; the

teeth on these bones also greatly enlarged. The body becomes deep and compressed; a fleshy hump is developed before the dorsal fin, and the scales of the back become imbedded in the flesh. The flesh, which is red and rich in spring, becomes dry and poor. Salmon, mostly of large size, ascending the rivers tributary to the North Pacific in North America and Asia, spawning in the fall. Only five species are certainly known. (57205, hook; 607705, snout.)

The species may be divided as follows:

- \*Gill-rakers comparatively short and few (20 to 25 in number).
- \*\* Gill-rakers comparatively long and numerous (30–40 in number); scales large; lat.
- \*Gill-rakers comparatively short and few (20-25 in number).
  - a. Scales very small, more than 200 in a longitudinal series.
- 493. O. gorbuscha (Walb.) Gill & Jordan.—Humpback Salmon; Haddo; Holia; Gorbuscha; Dog Salmon (Alaska).

Color bluish; sides silvery; back posteriorly, adipose fin, and tail with numerous black spots; fall males red, more or less blotched with brownish. Body rather slender, in the female plump and symmetrical, in the fall males very thin and compressed, with the fleshy dorsal hump much developed and the jaws much elongated, strongly hooked, and with extravagant canines in front. Ventral appendage half the length of the fin. B. 11–12. Gill-rakers 13 + 15. A. (developed rays) 15; D. 11; scales 215 (210–240), those of the lateral line larger, 170. Pyloric cœca very slender, about 180. Weight 3–6 pounds. Pacific coast and rivers of North America and Asia from Oregon northward; not rare; occasionally taken in the Sacramento. Known at once by the very small size of the scales.

(Salmo gorbuscha Walbaum, Artedi Pisc. 1792, 69: Salmo proteus Pallas, Zoogr. Ross. Asiat. iii, 376: Salmo gibber Bloch & Schneider, 409: Oucorhynchus proteus Günther, vi, 157: Salmo proteus Suckley, Monogr. Salmo, 97; Jordan, Proc. U. S. Nat. Mus. i, 71, 1878: Salmo scouleri Rich. Fauna Bor.-Amer. iii, 158. Oncorhynchus scouleri Günther, vi, 158.)

- aa. Scales medium, about 145 (138-155) in a longitudinal series; pyloric eœea about 150.
  b. Anal rays 13 or 14; black spots small or obsolete.
- 500. O. Keta (Walbaum) Gill & Jordan.—Dog Salmon; Hay-ko; Le Kai Salmon.
  Dusky above; sides paler, little lustrous; back and sides with no Bull. Nat. Ms. No. 16——20

defined spots, but only fine specklings, which are often entirely obsolete; head dusky, scarcely any metallic lustre on head or tail; caudal dusky, plain, or very finely maculate, its edge usually distinctly blackish; fins all mostly blackish, especially in males; breeding males generally blackish above, with sides brick-red, often barred or mottled. General form of the Quinnat, but the head proportionately longer, more depressed and pike-like; the preopercle more broadly convex behind, and the maxillary extending considerably beyond eye. Gill-rakers few, coarse, and stout, as in the Quinnat. Accessory pectoral scale short, not half the length of fin. Head 4; depth 4. D. 9; A. 13–14; scales about 28–150–30; B. 13 or 14, rather broad; gill-rakers 9 + 15; pyloric eœca 140–185; weight about 12 pounds. San Francisco to Kamtschatka, ascending all streams in the fall, and spawning at no great distance from the sea; abundant in Behring's Straits. At the time of its run the males of this species are much distorted and the flesh has little value.

(Salmo keta vel Kayko Walbaum, Artedi Pisc., 1792, 72: Salmo keta vel Kayko Bloch & Schneider, 1801, 407: Salmo lagocephalus Pallas, Zoogr. Ross. Asiat. iii, 372, 1811-'31: Salmo canis Suckley, Ann. Lyc. Nat. Hist. N. Y. 1858, 9, and Monogr. Salmo, 101: Oncorhynchus lagocephalus Günther, vi, 161.)

bb. Anal rays about 16; back and upper fins with black spots.

501. O. chouicha (Walb.) J. & G.—Quinnat Salmon; King Salmon; Columbia Salmon; Sacramento Salmon; Chinnook Salmon; Tyee Salmon; Fall Salmon (male); Spring Salmon; Winter Salmon; Saw-kwey; Chouicha.

Color dusky above, often tinged with olivaceous or bluish; sides and below silvery; head dark slaty, usually darker than the body and little spotted; back, dorsal fin, and tail usually profusely covered with round black spots (these are sometimes few, but very rarely altogether wanting); sides of head and caudal fin with a peculiar metallic tin-colored lustre; male, about the spawning season (October) blackish, more or less tinged or blotched with dull red. Head conic, rather pointed in the females and spring males. Maxillary rather slender, the small eye behind its middle. Teeth small, longer on sides of lower jaw than in front; vomerine teeth very few and weak, disappearing in the males. In the males in late summer and fall, the jaws become elongate and distorted, and the auterior teeth much enlarged, as in the related species. The body then becomes deeper, more compressed, and arehed at the shoulders, and the color nearly black. Preopercle and opercle strongly convex. Body comparatively robust, its depth greatest near its middle. Ventrals inserted behind middle of dorsal, ventral appendage half the length of the fin; caudal, as usual in this genus, strongly forked, on a rather slender caudal peduncle. Flesh red and rich in spring, becoming paler in the fall as the spawning season approaches. Head 4: depth 4. B. 15-16 to 18-19, the number on the two sides always unlike. D. 11; A. 16. Gill-rakers usually 9+14(i. e., 9 above the angle and 14 below). Pyloric eeca 140-185. Scales usually 27-146-29, the number in a longitudinal series varying from 140-155, and in California specimens occasionally as low as 135. Vertebræ 66. L. 36 inches. Usual weight in the Columbia River 22 pounds, elsewhere 16-18 pounds, but individuals of 70-100 pounds have been taken. Ventura River to Alaska and Northern China, ascending all large streams; especially abundant in the Columbia and Sacramento Rivers, where it is the principal salmon. Upwards of 30,000,000 pounds are now taken yearly in the Columbia River. It ascends the large streams in spring and summer, moving up, without feeding, until the spawning season, by which time many of those which started first may have travelled more than a thousand miles. After spawning, most or all of those which have reached the upper waters perish from exhaustion. It is by far the most valuable of our salmon. It has lately been introduced into many eastern streams.

(Salmo tshawytscha\* Walbaum, Artedi Pisc. 1792, 71: Salmo orientalis Pallas, Zoogr. Ross. Asiat. iii, 367, 1811-31: Salmo quinnat Rich. Fauna Bor.-Amer. iii, 219, and of writers generally: Oncorhynchus quinnat Günther, vi, 158: Oncorhynchus orientalis Günther, vi, 159: Oncorhynchus quinnat Jordan, Proc. U. S. Nat. Mus. i, 69: Favio argyreus Girard, Acad. Nat. Sei. Phila. 1856, 218: Salmo quinnat, confluentus, and argyreus Snekley, Monogr. Salmo, 105, 109, 110: Salmo tschawytscha Bloch & Schneider, 1801, 407.)

aaa. Scales comparatively large, about 130 (125-135) in a longitudinal series; pyloric eeca 50-80.

502. O. kisutch (Walb.) Jor. & Gilb.—Silver Salmon; Kisutch; Skowitz; Hoopid Salmon; Coho Salmon; Bielaya Ryba.

Bluish green; sides silvery, with dark punctulations; no spots except a few rather obscure on top of head, back, dorsal fin, adipose fin, and the rudimentary upper rays of the caudal; rest of the caudal fin unspotted; pectorals dusky tinged; anal with dusky edging; sides of head without the dark coloration seen in the Quinnat; males mostly red in fall, and with the usual changes of form. Body rather elongate, compressed. Head short, exactly conical, terminating in a bluntly pointed snout, which is longer and broader than the lower jaw. Head shorter than in a young Quinnat of the same size. Interorbital space broad and strongly convex. Opercle and preopercle strongly convex behind; the preopercle very broad, with the lower limb little developed. Cheeks

<sup>\*</sup>A barbarous spelling of the word "chouicha" which we have thought proper to simplify.

Eye quite small, much smaller than in young Quinnat of the Suborbital very narrow, with a row of mucous pores along Maxillary slender and narrow, but extending somewhat its surface. beyond the eye. Teeth very few and small, only two or three on the vomer; those on tongue very feeble. Gill-rakers 10 + 13, rather long and slender, nearly as long as eye, toothed. Fins small. and ventrals short, the ventral appendage three-fifths the length of the fin; caudal strongly forked, on a slender peduncle. Head 4: depth 4. Pyloric coca very few and large, 63 (45-80); scales 25-127-B. 13-14. D. 10: A. 13-14 (developed rays). L. 15 inches. Weight 3-8 pounds. A small salmon, ascending streams in the fall to no great distance. Abundant from San Francisco northward.

(Salmo kisutch Walbaum, Artedi Pisc. 1792, 70: Salmo kysutsch Bloch & Schneider, 1801, 407: Salmo sanguinolentus Pallas, Zoogr. Ross. Asiat. iii, 379: Oncorhyuchus sanguinolentus Giinther, vi, 160: Oncorhynchus lycaodom Giinther, vi, 155, in part: Salmo sconleri Suckley, Monogr. Salmo, 94: Salmo tsuppitch Richardson, Fauna Bor.-Amer. iii, 224, 1836: Salmo tsuppitch Giinther, vi, 118 (not of Jordan, Proc. U. S. Nat. Mus. i, 72. 1878, —Salmo purpuratus); Oncorhynchus tsuppitch, Jordan, Forest and Stream, September 16, 1880, 130.)

\*\* Gill-rakers comparatively long and numerous (30 to 40 in number); scales large, in about 130 series.

503. O. merka (Walbaum) Gill & Jordan.—Blue-back Salmon; Red-fish; Frazer's River Salmon; Sugk-eye Salmon; Krasnaya Ryba.

Color clear bright blue above; sides silvery, this hue overlying the blue of the back; lower fins pale, upper dusky; no spots anywhere in adults in spring; the young with obscure black spots above; males deep crimson red in the fall; the fins blackish, the caudal then often speckled with black; young breeding males ("Kennerlyi") often sharply spotted. Body elliptical, rather slender. Head short, sharply conic, pointed, the lower jaw included. Maxillary rather thin and small, extending beyond eye. Teeth all quite small, most of them freely movable; vomer with about 6 weak teeth, which grow larger in fall males, instead of disappearing. Preopercle very wide and convex; opercle very short, not strongly convex. Preoperele more free behind than in O. chouicha. Ventral scale about half the length of the fin; caudal fin narrow, widely forked; anal fin long and low; dorsal low. Flesh deep red. Males becoming extravagantly hook-jawed in the fall, the snout being then prolonged and much raised above the level of rest of head, the lower jaw produced to meet it. Mandible 1\frac{1}{3} in head, in fall males, 1\frac{3}{3} in females; snout 2½ in head, in fall males, 3½ in females. Head 4; depth 4. Gill-rakers as long as eye, more numerous than in any other of our salmon, usually 16-23. B. 14+13. D. 11; A. 14; scales 20-133-20; pylorie cœca 75-95. Vertebræ 64. L. 24 inches. Weight 4 to 8 pounds. Columbia River to Kamtschatka; generally abundant, especially northward; ascending streams in spring to great distances, and often frequenting mountain lakes in fall, spawning in their small tributaries; one of the most graceful of the *Salmonida*, scarcely inferior to the Quinnat when fresh, but the flesh more watery and less valuable when canned.

(Salmo nerka Walbaum, Artedi, Pisc. 1792, 71: Salmo nerka Bloch & Schneider, 1801, 417: Salmo lycaodon Pallas, Zoogr. Ross. Asiat. iii, 370: Salmo japonensis Pallas, l. c.: ? Salmo dermatinus and consuctus Richardson, Voyage Herald, Zoöl. 167, 168 (probably O. keta): Salmo paucidens Richardson, Fauna Bor.-Amer. iii, 222: Oncorhynchus lycaodon pt. and O. paucidens Günther, vii, 155, 158: Salmo cooperi, paucidens, warreni, and richardi, Suckley, Monogr. Salmo, 92, et seq.; Jordan, Man. Vert. 357; Jordan, Proc. U. S. Nat. Mus. i, 71, 1878: Salmo kennerlyi Suckley, Ann. Lyc. Nat. Hist. N. Y. vii, 307, 1861, and Monogr. Salmo, 145 (young male or grilse, in breeding season): Salmo kennerlyi Günther, vi, 120: Hypsifario kennerlyi Gill, Proc. Acad. Nat. Sci. Phila. 1862, 330: Oncorhynchus kennerlyi Jordan, Man. Vert. 357, and in Proc. U. S. Nat. Mus. i, 72, 1878: ? Salmo tapdisma, arabatsch, and melampterus Cuv. & Val. xxi, 314-6.)

### 150.-SALMO Linnæus.

#### Salmons.

(Artedi; Linnæus, Syst. Nat.: type Salmo salar L.)

Body elongate, somewhat compressed. Mouth large; jaws, palatines, and tongue toothed, as in related genera; vomer flat, its shaft not depressed, a few teeth on the chevron of the vomer, behind which is a somewhat irregular single or double series of teeth, which are sometimes deciduous with age. Scales large or small, 110-200 in a longitudinal series. Dorsal and anal fins short, of about 11 rays each; caudal fin truncate, emarginate, or forked, its peduncle comparatively stout. Sexual peculiarities variously developed; the males in typical species with the jaws prolonged and the front teeth enlarged, the lower jaw . being hooked upwards at the end and the upper jaw emarginate or perforate. In some species these peculiarities are little marked. Species of moderate or large size, black-spotted, abounding in the rivers and lakes of Northern America, Asia, and Europe; one or two Atlantic species marine and anadromous. The non-migratory species (subgenus Fario) are in both continents extremely numerous, closely related, and difficult to distinguish. The excessive variations in color and form have given rise to a host of nominal species. European writers have described numerous hybrids among the various species of Salmo, real and nominal, found in their waters; as also among the various European Cyprinidæ. We have thus far failed to find the slightest evidence of any hybridism either among our American Salmonidæ or Cyprinidæ, in a state of nature. Puzzling aberrant or intermediate specimens

certainly occur, but such are not necessarily "hybrids." (Salmo, the Latin name of S. salar, originally from salio, to leap.)

The following observations on the species of trout are taken, with some slight abridgment and alteration, from Dr. Günther's account of this family (Cat. Fish. Brit. Mus. vi):

There is no other group of fishes which offers so many difficulties to the ichthyologist, with regard to the distinction of the species, as well as to certain points in their life history, as this genus. \* \* \* The almost infinite variations of these fishes are dependent on age, sex, and sexual development, food, and the properties of the water. \* \* \* The coloration is, first of all, subject to variation, and consequently this character but rarely assists in distinguishing a species, there being not one which would show in all stages the same kind of coloration. The young in all the species of this genus are barred, and this is so constantly the ease that it may be used as a generic or even as a family character, not being peculiar to Salmo alone, but also to Thymallus and probably to Coregonus. The number of bars is not quite constant, but the migratory tront have two (or even three) more than the river-tront. When the Salmones have passed this "parr" state, the coloration becomes much diversified. The males, especially during and immediately after the spawning time, are more intensely colored and variegated than the females, specimens not mature retaining a brighter silvery color, and being more similar to the female fish. Food appears to have less influence on the coloration of the outer parts than on that of the flesh; thus, the more variegated specimens are frequently ont of condition, whilst well-fed individuals, with pinkish flesh, are of more uniform though bright colors, The water has a marked influence on the colors. Tront with intense occilated spots are generally found in clear, rapid rivers and in alpine pools; in the large lakes, with pebbly bottom, the fish are bright silvery, and the occilated spots are mixed with or replaced by X-shaped black spots; in dark holes, or lakes with peaty bottom, they often assume an almost uniform blackish coloration.

The brackish or salt water has the effect of giving them a bright-silvery coat, without or with few spots, none of them ocellated. With regard to size, the various species do not present an equal amount of variation. Size appears to depend on the abundance of the food and the extent of the water. Thus, the migratory species do not appear to vary considerably in size, because they find the same conditions in all the localities inhabited by them. A widely-spread species, however, like Salmo fario (or in America, Salmo purpuratus), when it inhabits a small mountain pool, with scanty food, never attains a weight of 8 ounces, while in a large lake or river, where it finds an abundance of food, it attains to a weight of 14 or 16 poinds. Such large river-tront are frequently named or described as Salmon-tront, Bull-trout, Steel-heads, etc.

The proportions of the various parts of the body to one another vary exceedingly, in the same species, with age, sex, and condition.

The fins vary to a certain degree. The variation in the number of rays in any one genus (except Oncorhyuchus) is inconsiderable, and of no value for specific distinction. Although some species appear to be distinguished by a comparatively low dorsal and anal fin, yet the proportion of the height of these fins to their length is a rather uncertain character. In most of the species the fin-rays are longer during the stages of growth or development. The candal fin especially undergoes changes with age. Young specimens of all species have this fin more or less deeply excised, so that the young of a species which has the caudal emarginate throughout life is distinguished by a deeper incision of the fin from the young of a species which has it truncate in the young state. The individuals of the same species do not all attain to maturity at the same size.

Finally, to complete our enumeration of these variable characters, we must mention that in old males, during and after the spawning season, the skin on the back becomes thickened and spongy, so that the scales are quite invisible or hidden in the skin.

After this cursory review of variable characters, we pass on to those which we have found to be constant in numbers of individuals, and in which it is difficult to perceive signs of modification due to external circumstances.

Such characters, according to the views of the zoologists of the present age, are sufficient for the definition of species; at all events, in every description they ought to be noticed, and the confused and unsatisfactory state of our knowledge of Salmonoids is chiefly caused by authors having paid attention to the more conspicuous but unreliable characters, and but rarely noted one of those which are enumerated here.

- 1. The form of the preoperculum of the adult fish.
- 2. The width and strength of the maxillary of the adult fish. In young specimens and in females the maxillary is proportionately shorter than in the adult.
  - 3. The size of the teeth, those of the premaxillaries excepted.
  - 4. The arrangement and permanence of the vomerine teeth.
- 5. The development or absence of teeth on the hyoid bone. In old examples these are often lost, and their absence in a species usually provided with them is not uncommon.
- 6. The form of the caudal fin in specimens of a given size, age, or sexual development.
- 7. The size of the scales, as indicated by counting the number of transverse rows above the lateral line. The scales of the lateral line are always more or less enlarged or irregular and the number of scales should be ascertained higher up; this is one of the most constant and valuable of all the specific characters.
- 8. A great development of the pectoral fins, when constant in a number of specimens from the same locality.
  - 9. The number of vertebra.
  - 10. The number of pyloric ceca.
  - 11. The number of gill-rakers.

### The species may be divided as follows:

- \*\*River salmon, not anadromous, with the vomerine teeth largely developed, those on the shaft of the bone numerous, persistent, in one zigzag row or two alternating rows; sexual differences not strongly marked, the male with the premaxillaries somewhat enlarged. (FARIO Valenciennes.)
  - a. Hyoid bone entirely toothless.
    - b. Scales large, 120-150 in a longitudinal series.
      - c. Caudal fin forked ......irideus.
    - cc. Candal fin truncate ......gairdneri.
  - bb. Scales small, 165-205 in a longitudinal series.
- \*Marine salmon, anadromous, with the vomerine teeth little developed, those on the shaft of the bone few and deciduous; scales large (Lat. l. 120); caudal fin well forked, truncate in old individuals; no hyoid teeth; sexual differences strong; breeding males with the lower jaw hooked upwards, the upper jaw emarginate or perforate to receive its tip. (Salmo.)

### 504. S. salar Linnaus. - Common Atlantic Salmon.

Body moderately elongate, symmetrical, not greatly compressed. Head rather low. Mouth moderate, the maxillary reaching just past the eye, its length 23-3 in head; in young specimens the maxillary is proportionately shorter. Preoperculum with a distinct lower limb. the angle rounded. Scales comparatively large, rather largest posteriorly, silvery and well imbricated in the young, becoming imbedded in adult males. Coloration in the adult brownish above, the sides more or less silvery, with numerous black spots on sides of head. on body, and on fins, and red patches along the sides in the males: young specimens (parrs) with about 11 dusky cross-bars, besides black spots and red patches, the color, as well as the form of the head and body, varying much with age, food, and condition; the black spots in the adult often X-shaped or X-shaped. Head 4; depth 4. B. 11; D. 11; A. 9; scales 23-120-21; vertebræ 60; pylorie cœca about 65. Weight 15-40 pounds. North Atlantic, ascending all suitable rivers in Northern Europe and the region north of Cape Cod; sometimes permanently land-locked in lakes, where its habits and coloration (but no tangible specific characters) change somewhat, when it becomes (in America) var. sebago. One of the best known and most valued of food-fishes.

(Linneus, Syst. Nat.; Günther, vi, 11, and of nearly all authors: Salmo gloveri Girard, Proc. Acad. Nat. Sci. Phila. 1854, 85: Salmo sebago Girard, Proc. Acad. Nat. Sci. Phila. 1853, 380; Suckley, Monogr. Salmo, 143: Salmo sebago and gloveri Günther, vi, 153.)

- \*\*River salmon, not anadromous, with the vomerine teeth largely developed, those on the shaft of the bone numerous, persistent, in one zigzag row or two alternating rows; sexual differences not strongly marked, the males with the premaxillaries somewhat enlarged; flesh often pale. (Fario Valenciennes\*).
  - a. Hyoid bone entirely toothless (tongue with teeth as usual).
    - b. Scales large, in 120-150 series.
      - c. Caudal fin forked.

### 505. S. irideus Gibbons. - California Brook Trout; Rainbow Trout.

Body comparatively short and deep, compressed, varying considerably, and much more elongate in the males than in the females. Head short, convex, obtusely ridged above. Mouth smaller than in any other species of the genus, the rather broad maxillary scarcely reaching beyond the eye except in old males. Eye larger than in our other species, 5 in head. Vomerine teeth in two irregular series. Dorsal fin

<sup>\*</sup>Valenciennes, Hist. Nat. Poiss. xxi, 227: type Fario argenteus Val. (Fario, a Latin name of the "Salmon Trout"; included species with a single row of permanent teeth on the vomer; Salar, Val. l. c. 314, included those with two rows, a distinction of no importance.)

moderate; caudal fin distinctly though not strongly forked, more deeply incised than in any other of our species of Fario. Scales compraatively large. Coloration bluish above, the sides silvery; everywhere above profusely but irregularly spotted, the spots extending on the sides and on the vertical fins; spots on caudal small; belly nearly plain; sea-run specimens nearly plain silvery; males with red lateral band and blotches. Head 4; depth 3\frac{4}{5}. D.11; A.10; scales 21–135–20, varying considerably, the highest number noted being on the type of "Fario newberrii", 33–146–33. L. 24 inches. Weight \frac{1}{2} to 6 pounds. Streams west of the Sierra Nevada, from near the Mexican line (Rio San Luis Rey) to Oregon; very abundant, and subject to many variations in size, form, and color.

(Gibbons, Proc. Cal. Acad. Nat. Sci. 1855, 36; Günther, vi, 119; Suckley, Monogr. Salmo, 129; Jordan, Proc. U. S. Nat. Mus. i, 75: Fario gairdneri Girard, U. S. Pac. R. R. Surv. Fish, x, 313 (not Salmo gairdneri Rich.): Fario newberrii Girard, Proc. Acad. Nat. Sci. Phila. 1858, 224: Fario clarkii, Girard, Proc. Acad. Nat. Sci. Phila. 219 (not S. clarkii Rich.): Salmo masoni Suckley, Monogr. Salmo, 134.)

cc. Candal fin truncate (in the adult).

506. S. gairdneri Rich.—Steel-head; Hard-head; Salmon Trout.

Body rather stout, not very deep mesially, but with the caudal pe-Head comparatively short and rather slender, in the duncle thick. females small, in the males the jaws more or less prolonged; maxillary rather narrow, the small eye nearly above its middle; lower jaw included: upper jaw in males emarginate at tip and at junction of premaxillary. Teeth rather small, those on the vomer in two long, alternating series, which are about as long as the palatine series. Preopercle rather wide, with the lower limb short; opercle moderate. Gill-rakers short and thick, 8+12 (essentially as in our other species of Fario). Ventral appendage not half the length of the fin. Tail wide, squarely truncate in the adult, somewhat emarginate in the young. Flesh rather pale. Bones much firmer than in the Oncorhynchi. Color blue above; sides silvery; head, back, upper fins, and tail more or less densely covered with black spots; belly usually unspotted; males with colors heightened, the back greenish; a broad flesh-colored lateral band, deep red on the opercles; fins not red; no red on the membrane of lower jaw; B. 12-11; D. 11; A. 12; scales 20-135-20; pyloric cœca 42; vertebræ L. 30 inches. Sacramento River and northward. A large trout, abounding in the mouths of the rivers, reaching a weight of 20 pounds. It spawns later than the salmon, and is found in the rivers, spent, at the time of the spring salmon run. It is then nearly useless as food, but at other times similar in quality to other trout.

(? Salmo mykiss Walbaum, Artedi, Pisc. 1792, 59, apparently confused with S. purpuratus: ? Salmo muikisi Bloch & Schneider, 419: Salmo purpuratus Günther, vi, 116: Salmo

truncatus Suckley, Ann. Lyc. Nat. Hist. N. Y. 1858, 3: Salmo gairdneri Richardson, Fauna Bor.-Amer. iii, 221: Salmo gairdneri Suckley, Monogr. Salmo, 114: Salmo truncatus Günther, vi, 122: Salmo gairdneri Günther, vi, 118.)

- bb. Scales small, 165-205 in a longitudinal series.
  - d. Caudal fin truncate or double-rounded, not at all forked in the adult.

### 507. S. Spilurus Cope.-Rio Grande Trout.

Body elongate. Head heavy, but proportionately short, its upper surface considerably decurved; interorbital space transversely convex, obtusely carinated; the head more convex than in any other of our species. Mouth very large, the maxillary reaching far past the eye. Teeth on vomer in two distinct series. Dorsal fin low in front, high behind, the last ray more than two-thirds the height of the first; last ray of the anal rather long; caudal with its middle rays about as long as the others. Profusely spotted; back and sides with round black spots, the spots most developed posteriorly, few on the head, most numerous on the caudal and adipose fin; sides with pale blotches. Head  $3\frac{1}{2}$ ; depth 4. D. 11; A. 10; scales 37-170-37. L. 30 inches. Upper Rio Grande and Basin of Utah, frequenting mountain streams.

(Cope, Hayden's Geol. Surv. Mont. 1871, 470, 1872; Jordan, Proc. U. S. Nat. Mus. i, 74.)

# Var. pienriticus (Cope) Jor.

A more abundant and much more widely distributed form, having the head and mouth equally large, but the top of the head less convex, the median carina being more marked, especially in the young. The scales are definitely smaller (39-200-40) and the coloration is rather darker. This form abounds in all suitable streams from the Rio Grande, through the Basin of Utah. Specimens intermediate between spilurus and pleuriticus occur.

(Salmo plcuriticus Cepe, Hayden's Geol. Surv. Mont. 1871, 471, 1872; Jordan, Proc. U. S. Nat. Mus. i, 74, 1878.)

aa. Hyoid bone with a narrow band of small teeth (easily scraped off and very often naturally deciduous, especially in old examples).

508. S. purpuratus Pallas.—Salmon Trout of the Columbia; Yellowstone Trout; Rocky Mountain Brook Trout; Lake Trout.

Body moderately elongate, compressed. Head rather short. Mouth moderate, the maxillary not reaching far beyond the eye. Vomerine teeth as usual, set in an irregular zigzag series; teeth on the hyoid bone normally present, but often obsolete, especially in old examples. Dorsal fin rather low; caudal fin slightly forked, less so than in *irideus*, more than in *spilurus* (the caudal more forked in young individuals

than in the adult, as in all trout). Scales moderate, varying to rather Back and caudal peduncle profusely covered with rounded black spots of varying size: dorsal, candal, and adipose fin covered with small spots about as large as the nostril: a few spots on the head: belly rarely spotted; inner edge of the mandibles below with a red blotch; sea-run specimens are nearly uniform silvery; males with a broad lateral band and patches of light red; extremely variable in color and form. Head 4; depth 4. D. 10; A. 10. Cœca 43. Scales variable in size, 33-150-30 to 39-170-30. The common trout of the Rocky Mount. ains and Cascade region, abounding in all the streams of Alaska, Oregon, and Washington, where it descends to salt water, and reaches a weight of 20 pounds (Columbia River, Charles J. Smith); also in the Yellowstone region, the Upper Missouri, the Upper Rio Grande, Colorado, and the lakes of the Great Basin of Utah, being very abundant in Utah Lake. Not common south of Mount Shasta in California. This species is apparently the parent stock, from which our other blackspotted trout have scarcely yet become differentiated. Considerable local variations occur, especially in size, coloration, and size of scales. The red blotches on the lewer jaw between the dentary bones and the membrane joining them is very constant and characteristic.

(Salmo purpuratus Pallas, Zöol. Ross. Asiat., iii, 374, 1811–31: Salmo clarki Rich. Fauna Bor.-Amer. iii, 224, 1833: Fario stellatus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 219: Salmo brevicauda Suckley, Ann. Lyc. Nat. Hist. N. Y. vii, 308, 1861: Salmo stellatus, gibbsi, and brevicauda Günther, vi, 117–120: Salmo clarki Jordan, Proc. U. S. Nat. Mus. i, 77: Salmo tsuppitch Jordan, Proc. U. S. Nat. Mus. i, 72; Fario aurora Girard, Proc. Acad. Nat. Sci. Phila. viii, 218, 1856: Salar lewisi Grd. Proc. Acad. Nat. Sci. Phila. 1856, 219: Salar virginalis Girard, l. c. 220: Salmo carinatus Cope, Hayden's Geol. Surv. Mont. 1871, 471–472: Salmo utah Suckley, Monogr. Salmo, 136: Salmo aurora, lewisi, and virginalis Günther, vi, 119–123.)

### Var. bouvieri Bendire. -- Waha Lake Trout.

Similar to S. purpuratus, but with dark spots only on the dorsal, caudal, and adipose fin, and on the tail behind front of anal, where the spots are very profuse, smaller than pupil. Anterior regions dusky bluish, not silvery; red blotch on inner edges of dentary bones below very conspicuous. Head shorter and deeper than in purpuratus, the snout shorter and blunter, not longer than eye, which is 4 in head. Opercle and preopercle less convex than in purpuratus. Maxillary 2½ in head. Caudal moderately forked. Head 4; depth 4½. D. 10; A. 11; B. 12; Lat. l. 175. Size small. A singularly colored local variety, found in Waha Lake, Washington Territory, a mountain lake without outlet. (Salmo bouvieri Bendire, MSS.)

Var. stomias (Cope) J. & G.

Body short and stout. Head large and wide, above broad and flat, without keel, with wide mandible and mouth, the end of the maxillary extending half the diameter of the eye beyond the orbit. Eye  $4\frac{9}{3}$  in head. Maxillary bone of nearly uniform width. Caudal fin truncate. General coloration of S. spilurus, the black spots most numerous posteriorly. Head  $4\frac{1}{4}$ ; depth  $4\frac{1}{4}$ . D. 12; A. 10; scales 42 above lateral line, which probably contains about 200 scales. L. 24 inches. Kansas River to Upper Missouri. (Cope.) Like S. spilurus in its large mouth and very small scales, but differing in the presence of hyoid teeth and in the broad, flat head. We have seen only the head of an old male of this form, but think it will prove to be a variety of S. purpuratus.

(Salmo stomias Cope, Hayden's Geol. Surv. Wyom. 1870, 433, 1872: Salmo stomias Jordan, Hayden's Geol. Surv. Terr. 1878, 795.)

Var. Benshawi Gill & Jordan.-Lake Tahoe Trout; Silver Trout; Black Trout.

Body elongate, not greatly compressed. Head comparatively slender and long-acuminate, its upper surface very slightly carinated; muzzle somewhat pointed, but bluntish at the tip; head not convex above: maxillary rather short, about as in purpuratus, not reaching much beyond the eye. Vomerine teeth as usual; a small, rather narrow, but usually distinct patch on the hyoid bone. Dorsal fin small; caudal fin short, rather strongly forked. Scales medium. Coloration dark, the sides silvery; back about equally spotted before and behind: sides with rather distant spots; belly generally spotted; head spotted even to the snout; dorsal and caudal also spotted. Head  $3\frac{3}{4}$ ; depth 4. D. 11; A. 12; scales 27-160-27 to 37-184-37; eeeca 50-60. L. 18 inches or more, usually weighing 5 or 6 pounds, but occasionally 25-30. Lake Tahoe, Pyramid Lake, and streams of the Sierra Nevada. Evidently a variety of Salmo purpuratus, but with a longer and more conical head. A fine trout, now common in the San Francisco markets.

(Salmo henshawi Gill & Jordan, Man. Vert. ed. 2, 358: Salmo henshawi and Salmo tsuppitch Jordan & Henshaw, Rept. Chief Eng., 1878, App. NN, 196, 197, plate: Salmo henshawi Jordan, Proc. U. Nat. Mus. i, 75, 1878.)

#### 151.—SALVELINUS Richardson.

Charrs.

(Baione DeKay; Umbla Rapp.)

(Nilsson; Richardson, Fauna Bor.-Amer. iii, 170, 1833: type Salmo salvelinus L.)

Body moderately elongate. Mouth large or small. Teeth of jaws, palatines, and tongue essentially as in Salmo, the hyoid patch present

or not. Vomer boat-shaped, the shaft much depressed, with or without raised crest, with teeth on the chevron and none directly on the shaft. Scales very small, in 200-250 rows. Fins moderate, the caudal forked in the young, truncate in some species, in the adult. Sexual peculiarities not strongly marked, the males with the premaxillaries enlarged and a fleshy projection at the tip of the lower jaw. Coloration dark, with round crimson or gray spots, and the lower fins sometimes with marginal bands of black, reddish, and pale. Species numerous in the clear streams and lakes of the northern parts of both continents, sometimes descending to the sea, where they lose their variegated colors and become nearly plain and silvery. The members of this genus are in general the smallest and handsomest of the trout. (Salvelinus, an old name of the charr; allied to the German Sülbling, a little salmon.)

\*Vomer with a raised crest behind the ehevron, free from the shaft; the crest armed with teeth; hyoid teeth strong; lake trout, gray-spotted (\*Cristivomer\*\* Gill & Jordan\*).

509. S. nammycush (Walb.) Goode.—Mackinaw Trout; Great Lake Trout; Longe (Vermont); Toque (Maine).

Body elongate, covered with thin skin, there being no special development of fatty tissue. Head very long, its upper surface flattened. Mouth very large, the maxillary extending much beyond the eye, the head and jaws proportionately lengthened and pointed. Teeth very strong. Caudal fin well forked. Adipose fin small. General coloration dark gray, sometimes pale, sometimes almost black; everywhere with rounded paler spots, which are often reddish tinged; head usually vermiculate above; dorsal and caudal reticulate with darker. Eye arge, 4½ in head. Maxillary nearly half the length of the head; interorbital space nearly ¼. Head 4¼; depth 4. B. 11-12; D. 11; A. 11; Lat. l. 185-205. L. 36 inches. Great Lake region and lakes of Northern New York, New Hampshire, and Maine, to Montana and northward; very abundant in the larger bodies of water; varying in form and color in the different lakes.

(Salmo namayensh Walb. Artedi, Pisc., 1792, 68: Salmo namayensh Giinther, vi, 123, and of authors generally: Salmo amethystinus Mitchill, Journ. Acad. Nat. Sci. Phila. 1818 410: Salmo confinis DeKay, N. Y. Fauna, Fish. 1842, 238: Salmo adarondaens Norris: Salmo toma Hamlin: Cristiromer namayensh Jordan, Man. Vert., ed. 2d, 359: Salmo siscowet Giinther vi, 123.)

<sup>\*</sup>Jordan, Man. Vert. ed. 2, 1878, 356: type Salmo namayeush Walbaum. (Crista, crest; vomer, vomer.)

Var. siscowet (Agassiz) J. & G .- Siscowet Salmon.

Body short and deep, covered with thick skin, there being an excessive tendency to the development of fatty tissue. Head very short and deep, its upper surface broad and short, covered by a skin so thick as to completely hide the bones; no distinct median carina. Mouth very large, its gape narrower than in S. namayeush. Teeth weaker than in S. namayeush; supplemental bone also shorter and broader. Maxillary a little more than half the length of the head. Caudal fin well forked. Scales rather small, about 175 in the lateral line. Coloration as in S. namayeush, but usually paler; fin-rays the same. Lake Superior; abundant, but not yet found elsewhere. Very close to the preceding, but differing in the shortness and breadth of the bones of the head and in the extreme fatness of the flesh. It is probably a local variety rather than a distinct species.

(Salmo siscowet Agassiz, Lake Superior, 1850, 333.)

\*\* Vomer without raised erest, the chevron only being toothed; red-spotted. (Salrelinus.)

a Hyoid bone with a narrow median band of teeth (sometimes lost).

## 510. S. ognassa (Grd.) Gill & Jor.—Oquassa Trout; Blue-back Trout.

Body elongate, considerably compressed, less elevated than in the other species of this genus, the dorsal outline regularly but not strongly curved. Head quite small, much smaller than in any other of our trout, its upper surface flattish. Mouth quite small, the maxillary short and moderately broad, scarcely extending to the posterior margin of the eye. Eve large, 31 in head. Jaws about equal. small, those along the lateral line somewhat enlarged. Pectoral and ventral fins not elongate; candal fin well forked, more so than in the other species. Preopercle as in S. fontinalis, but the lower limb more developed; opercles without concentric striæ. Coloration dark blue, the red spots small and round, much smaller than the pupil, usually confined to the sides of the body; sides with traces of dark bars; lower fins variegated, as in S. fontinalis. Head 5; depth 5. D. 10; A. 9. Lat. l. 230; gill-rakers about 6+11. L. 12 inches. Smallest and handsomest of our trout, as yet known only from the Rangeley Lakes, in Western Maine.

(Salmo oquassa Girard, Proc. Acad. Nat. Sci. Phila. 1854, 262: Salmo oquassa Giinther, vi, 154; Jordan, Proc. U. S. Nat. Mus. i, 81.)

### 511. S. narcsi (Günther) Bean.

Greenish above, sides silvery or deep red, with very small red spots, much smaller than the pupil; lower fins deep red, with the anterior margins yellowish white. Body long and slender; head rather small, the snout blunt; month not large, the maxillary reaching posterior margin of orbit in male only; teeth very small; teeth on the middle line of the hyoid bone; angle of preopercle much rounded; gill-covers without concentric striæ; pectoral not longer than the head without snout; ventrals not to vent; caudal deeply forked; scales minute. Head  $4\frac{1}{4}$ ; depth 5-6. D. 11; A. 9; B. 11; coca 28-42; vert. 63. L. 12 inches. (Günther.) Lakes of Arctic America, Discovery Bay, and Cumberland Gulf.

(Salmo narcsii Günther, Proc. Zoöl. Soc. Lond. 1877, 476, plate; Bean, Bull. U. S. Nat. Mus. xv. 135.)

# 512. S. arcturus (Gthr.) Gill & Jor.

Dull greenish, silvery or reddish below; lower fins yellowish; no red spots (on specimens seen). Body rather elongate; head small, the snout very obtuse; month moderate, the maxillary in the male reaching about to posterior margin of orbit; teeth small; a band of hyoid teeth; preoperele with a distinct lower limb; pectoral little shorter than head, reaching more than half way to ventral. Caudal moderately forked; seales minute. Head 4½; depth 5; D. 11; A. 10; B. 11; ccca 31-44 L. 12 inches. Victoria Lake and Floeberg Beach, Arctic America, the northernmost Salmonoid known. (Günther.)

(Salmo arcturus Günther, Proc. Zoöl. Soc. Lond. 1877, 294, plate.)

513. S. maima (Walb.) J. & G.—Dolly Varden Trout; Bull Trout; Red-spotted Trout; Salmon Trout; Malma; Golet.

Body stout, the back somewhat elevated, deeper and less compressed than in *S. fontinalis*. Head large, snout broad, flattened above. Month large, the maxillary reaching past the eye. Eye 4½ in head. Fins short; the caudal fin slightly forked or almost truncate; adipose fin usually large; in large specimens its length is twice that of the eye. General color olivaceous; the sides with round red spots near the size of the eye, the back commonly with smaller pale ones, a feature of coloration which distinguishes this species at once from the others; lower fins colored as in *fontinalis*, dusky, with a pale stripe in front, followed by a dark one; sea-run specimens silvery, with the spots faint or obsolete; fins and back without dark reticulations. Gill-rakers without concentric striæ. Head 3½; depth 4. D. 11; A. 9; scales 39–240–36; pyloric cæca large, 45–50; gill-rakers about 8+12 as in others. L. 15 inches. Streams west of the Cascade Range, from Northern California to Alaska

and Kamtschatka, generally abundant northward, descending to the sea, where it reaches a weight of about 12 pounds.

(Salmo malma Walbaum Artedi, Pisc. 1792, 66: Salmo callarias Pallas Zoogr. Rosso-Asiat. iii, 353, 1811-31: Salmo callarias Günther, vi, 143: Salmo spectabilis Girard, Proc. Acad. Nat. Sei. Phila. 1856, 218: Salmo parkei Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 309: Salmo campbelli Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 313: Salmo parkii, lordii, and campbellii Günther, vi, 121, 148, 149: Salrelinis spectabilis Jordan, Proc. U. S. Nat. Mus. i, 79, 1878: Salmo tudes Cope, Proc. Amer. Phil. Soc. Phila. 1873: Salmo bairdii Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 309: Salmo bairdii Günther, vi, 121; Salvelinus bairdi Jordan, Proc. U. S. Nat. Mus. i, 82.)

aa. Hyoid teeth wanting.

## 514. S. fontinalis (Mitch.) Gill & Jor. - Brook Trout: Speckled Trout.

Body oblong or elongate, moderately compressed, not much elevated. Head large, but not very long, the snout bluntish, the interorbital space rather broad. Mouth large, the maxillary reaching more or less beyond Eye large, usually somewhat above the line of the axis of the body. Caudal fin slightly lunate in the adult, forked in the young: adipose fin small; pectoral and ventral fins not especially elongate. Red spots on the sides, rather smaller than the pupil; back mostly without spots, more or less barred or mottled with dark olive or black; dorsal and caudal fins mottled or barred with darker; lower fins dusky, with a pale, usually orange band anteriorly, followed by a darker one; belly in the males often more or less red; sea-run individuals (S. canadensis Smith, the Canadian "Salmon Trout") are often nearly plain bright silvery; many local varieties distinguished by shades of color also occur. Head 41; depth 41. D. 10; A. 9; scales 37-230-30; gill-rakers about 6+11. L. 18 inches or less. The best known of our trout, abounding in all clear, cold streams from Pennsylvania to Dakota and northward to the Arctic Circle, southward in the Alleghanies to the headwaters of the Savannah, Chattahoochee, Catawba, and French Broad.

(Salmo fontinalis Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 435: Salmo fontinalis Günther, vi, 152, and of nearly all authors: Salmo canadensis\* Hamilton Smith, in Griffith's Cuvier, x, 474, 1834 (Canadian "Salmon Trout"): Salmo immaculatus\* H. R. Storer, Bost. Journ. Nat. Hist. vi, 364, 1850 (Canadian "Salmon Trout"): Salmo immaculatus Günther, vi, 125: Salmo hudsonicus Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 310: Salmo hudsonicus Günther, vi, 153; Jordan, Proc. U. S. Nat. Mus. i, 81: ? Salmo hearnii Rich. Franklin's Journ. 703.)

### 515. S. hoodi (Rich.) Gill & Jor.

Body rather elongate. Maxillary rather strong, straight, extending to or beyond hind margin of eye. Preopercle very short, with a very short lower limb. Pectoral not reaching half way to ventral; adipose

<sup>\*</sup>The nominal species canadensis and immaculatus are based on sea-run specimens of larger size, the so-called "Salmon Trout".

fin very small; caudal deeply forked. Body and caudal fin covered with round pale spots of moderate size. B. 12; D. 10; A. 9; Lat. l. 185. Boothia. (Günther.)

(Salmo hoodii Richardson, Ross, Voy. Nat. Hist. App. lviii, and in Fauna Bor.-Amer. iii, 173: Salmo hoodii Günther, vi, 150.)

### 516. S. rossi (Rich.) J. & G.

Olive-brown above, the dorsal and caudal similarly colored; belly red; scattered red spots near the lateral line. Rather slender; snout very obtuse; lower jaw remarkably long, with a knob at tip (male). About 30 teeth on the tongue. Conspicuous pores on the face bones posteriorly. Scales very small, imbedded. Head 5. B. 12–13; D. 13; A. 11; P. 14; V. 10. Arctic Ocean, about Boothia Felix. (Richardson.) An imperfectly known species.

(Salmo rossii Richardson, Nat. Hist. App. Ross's Voy. lvi: Salmo rossii Suckley, Monogr. Salmo, 120.)

## 517. S. nitidus (Rich.) Gill & Jor.

Body somewhat elongate; head moderate; snout medium. Maxillary straight, strong, extending beyond the orbit in the male. Teeth moderate, 2 or 3 behind head of vomer. Preopercle with the lower limb very distinct. Fins well developed; pectoral reaching scarcely half way to ventral; caudal fin forked. Head 5. B. 11; D. 11; A. 10; Lat. 1. 215. Boothia. (Günther.) Perhaps a form of S. stagnalis.

(Salmo nitidus Richardson, Fauna Bor.-Amer. iii, 171, 1836: Salmo nitidus Günther, vi, 150.)

### 518. S. stagnalis (Fabr.) Gill & Jor.

Body elongate; head of moderate size. Snout elongate, pointed, with the lower jaw projecting beyond the upper in adult examples. Teeth small. Maxillary elongate, narrow, extending beyond the eye. Preopercle very short, with a very short lower limb. Opercle and preopercle very conspicuously and densely striated, the strice radiating from the base of each. Fins much developed, the dorsal much higher than long; pectoral very long, reaching more than half way to ventrals, which are also very long; adipose fin very small; caudal well forked. D. 11; A. 10; Lat. l. 210; B. 11; ecca, 41. Lakes of Greenland and Boothia Felix. (Günther.)

(Salmo stagnalis Fabricius, Fanna Gramlandica, 1780, 175: Salmo alipes Richardson, Nat. Hist. App. Ross's Voy. lvii, and Fauna Bor.-Amer. iii, 169: Salmo alipes Günther, vi, 149.)

Bull. Nat. Mus. No. 16——21

# FAMILY XLVII.—PERCOPSIDÆ.

(The Trout Perches.)

Body moderately elongate, somewhat compressed, the caudal peduncle long and slender. Head conical, pointed, naked. Mouth small, horizontal; maxillary short, narrow, without supplemental bone, not reaching to the large eye; margin of upper jaw formed by premaxillaries alone, which are short and not protractile. Teeth very small, villiform on premaxillaries and lower jaw only. Tongue short, adherent. Gill-membranes separate, free from the isthmus. Pseudobranchiæ present. Branchiostegals 6. Gill-rakers short, tubercle-like. Opercle with entire edges. Lower limb of the preopercle well developed, the angle nearly a right angle, its inner edge with a raised crest. Bones of the head eavernous, as in Acerina and Ericymba. Cranium with a raised crest, which does not extend to the occiput. Scales moderate, rather thin, adherent, their edges strongly etenoid. Lateral line continuous. Dorsal short, median; ventrals anterior, just in front of the dorsal, 8-rayed; pectorals narrow, placed rather higher than usual; anal small; candal forked; adipose fin present, small. Stomach siphonal, with about 10 well-developed pyloric eeca. Ova rather large, not falling into the abdominal cavity before exclusion. Air-bladder present. Small fishes of the fresh waters of the cooler parts of America; a single genus, with probably but one species. The group is one of special interest, as it combines with ordinary Salmonoid characters the structure of the head and mouth of a Percoid, resembling notably the European genus Acerina.

(Percopsida Günther, vi, 207.)

#### 152.—PERCOPSIS Agassiz.

#### Trout Perch.

(Agassiz, Lake Superior, 1850, 284: type Percopsis guttatus Ag.)

Characters of the genus included above. ( $\pi \varepsilon \rho z \eta$ , perch;  $\delta \psi \varepsilon \varepsilon$ , appearance.)

## 519. P. guttatus Agassiz.

Pale olivaceous, a silvery stripe along the lateral line, becoming obsolete forwards; upper parts with obscure round dusky spots made of dark points. Head slender and conical. Mouth small, subinferior, maxillary not nearly reaching front of orbit. Caudal peduncle long and

slender. Peritoneum silvery. Head  $3\frac{4}{5}$  in length; depth about  $4\frac{1}{3}$ . D. 11; A. 8; Lat. l. 50. L. 6 inches. Spawns in spring. Delaware River to Kansas and northward; abundant in the Great Lakes. One of our most remarkable fishes.

(Agassiz, Lake Superior, 1850, 283; Günther, vi, 207; ? Percopsis hammondi \* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 151.)

# ORDER N.-HAPLOMI.

(The Haplomous Fishes.)

No precoracoid arch. Parietal bones separated by the supraoccipital. A symplectic. Opercular bones present. Anterior vertebræ unaltered. Pharyngeal bones distinct, the superior directed forwards, three or four in number, the inferior not falciform. No interclavicles. Mouth with teeth. Air-bladder with a pneumatic duct. Ventral fins abdominal, rarely wanting; pectoral fins placed low; dorsal fin more or less posterior, usually without spines. Head and body usually with cycloid scales. No adipose fin. Species chiefly inhabiting fresh water.  $(\delta\pi\lambda u\delta z, \sin\mu b)$ , simple;  $\delta\mu uz$ , shoulder; in allusion to the want of the precoracoid arch.)

(Physostomi part (families Esocidw, Umbridw, Cyprinodontidw and Heteropygii) Günther, vi, vii.)

#### ANALYSIS OF FAMILIES OF HAPLOMI.

- a. Margin of upper jaw formed by premaxillaries alone; ovoviviparous.
- aa. Margin of upper jaw formed laterally by the maxillaries; premaxillaries not protractile.

## FAMILY XLVIII.—AMBLYOPSIDÆ.

# (The Blind-fishes.)

Body moderately elongate, compressed behind. Head long, depressed. Mouth rather large, the lower jaw projecting; premaxillaries long, scarcely protractile, forming the entire margin of the upper jaw. Jaws and palatines with bands of slender villiform teeth. Branchiostegals about 6. Gill-rakers very short. Pseudobranchiæ concealed. Gill-membranes more or less completely joined to the isthmus.

<sup>\*</sup>Head larger,  $3\frac{1}{2}$  in length, exclusive of candal; dorsal higher, the longest ray  $4\frac{3}{3}$  in length; anal higher, longest ray 6 in length; pectoral equals height of dorsal; ventral  $5\frac{3}{4}$  in length, reaching vent, which is nearer shout than margin of candal fin. Kansas. (Gill.)

Head naked, the surface sometimes crossed by papillary ridges. with small eveloid scales, irregularly placed? No lateral line. Vent jugular, close behind the gill-openings. Ventral fins small or wanting: pectorals moderate, inserted higher than in most soft-rayed fishes; dorsal without spine, nearly opposite the anal; caudal truncate or rounded. Cranium without median crest. Stomach ceeal, with one or two pyloric appendages. Air-bladder present. Ovary single. Some (and probably all) of the species are ovoviviparous. In two of the genera the eyes are very rudimentary and hidden under the skin, and the body is translucent and colorless. Fishes of small size, living in subterranean streams and ditches of the Central and Southern United States. Three genera and four species are "all of the family yet known, but that others will be discovered, and the range of the present known species extended, is very probable. The ditches and small streams of the lowlands of our southern coast will undoubtedly be found to be the home of numerous individuals, and perhaps of new species and genera, while the subterranean streams of the central portion of our country most likely contain other species." (Putnam.)

(Heteropygii Günther, vii, 1, 2.)

- a. Eyes rudimentary, concealed; body colorless.
- b. Ventral fins present......Amblyopsis, 153.

#### 153.-AMBLYOPSIS DeKay.

(DeKay, New York Fauna, Fish. 1842, 187: type Amblyopsis spelwus DeKay.)

Eyes rudimentary, concealed under the skin. Surface of head crossed by vertical tactile ridges. Gill-membranes fully joined to isthmus. Ventral fins present, quite small, close to anal. Colorless fishes of small size, inhabiting the cave-streams in the limestone regions of the Western States. ( $a\mu\beta\lambda\delta_5$ , obtuse;  $\delta\psi i_5$ , vision.)

### 520. A. spelæns DeKay.

Colorless. Mouth comparatively large, the length of its cleft about equal to base of dorsal. Pectorals reaching front of dorsal; caudal long, rather pointed. One pyloric cocum. Head 3 in length; depth 4½. D. 9; A. 8; V. 4; P. 11. L. 5 inches. Subterranean streams of Kentucky and Indiana.

(DeKay, New York Fauna, Fish. 187; Günther, vii, 2; Putnam, Amer. Nat. 1872, 30, fig.)

#### 154.--TYPHLICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 62: type Typhlichthys subterraneus Grd.)
This genus differs from Amblyopsis only in the absence of the ventral

fins. The species are of smaller size, and are found in the same waters.  $(\tau v\varphi\lambda\delta_5, \text{ blind}; i\gamma\theta\delta_5, \text{ fish.})$ 

#### 521. T. subterraneus Grd.

Colorless. Head rather blunter and broader forwards than in A. spelæus. Mouth smaller, its eleft shorter than base of dorsal. Pectorals scarcely reaching dorsal. One pyloric cœcum. D. 7 or 8; A. 7 or 8. L. 2 inches. Subterranean streams of Kentucky, Tennessee, and Alabama.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 62; Putnam, Amer. Nat. 1872, 30, fig.)

### 155.—CHOLOGASTER Agassiz.

(Agassiz, Amer. Journ. Sci. Arts, xvi, 135, 1853: type Chologaster cornutus Ag.)

This genus has the general characters of Amblyopsis, but differs in the absence of ventral fins and in the fully developed condition of the eyes, which are small and lateral. The species are not pellucid, but colored like ordinary fishes. No papillary ridges. Pyloric cœca 2. Ditches and cave-streams. ( $\chi\omega\lambda\nu\varsigma$ , maimed;  $\gamma\alpha\sigma\tau\dot{\eta}\rho$ , belly; in allusion to the abortive ventrals.)

### 522. C. cornutus Ag.

Yellowish brown, dark above; sides with three dark longitudinal stripes, becoming dots on the tail; middle rays of caudal fin dark; fins otherwise uncolored. Mouth moderate, oblique, the maxillary not extending to the eye. Pectorals reaching nearly to front of dorsal, perfect, small. Shout with two horn-like projections. Head  $3_8^1$ ; depth  $4_2^1$ . D. 8 or 9; A. 8 or 9. L.  $2_2^1$  inches. Ditches in a rice-field, Waccamaw, S. C. (Putnam.)

(Agassiz, Amer. Journ. Sci. Arts, 1853, 135; Günther, vii, 2; Putnam, Amer. Nat. 1872, 30.)

#### 523. C. agassizi Putnam.

Uniform light brown; fins somewhat speckled. Head 4 in body, its length searcely greater than the greatest depth. Pectorals reaching little more than half way to front of dorsal. D. 9; A. 9. L. 1<sup>1</sup>/<sub>4</sub> inches. (*Putnam.*) Subterranean streams in Tennessee and Kentucky.

(Putnam, Amer. Nat. 1872, 30, fig.)

A specimen of *Chologaster* obtained by Prof. S. A. Forbes in a cavestream of Southern Illinois does not agree well with either of the above species. The following description has been furnished us by Professor Forbes:

The head is  $7\frac{1}{2}$  mm long, and the body, without head or tail, 19 mm. Head in length, therefore,  $3\frac{1}{2}$  times. The eye is above and well behind the maxillary, and goes about

6 in head. The pectoral reaches half way to the dorsal. The color is precisely as described for *cornutus*, except that the middle stripe is decidedly paler than the ground color of the body, but darker on the head, the change being abrupt at the opercular margin. The caudal fin is dark brown, with several vertical rows of white specks or blotches running across the rays. The anterior part of the dorsal is similar in color, but paler. Total length a trifle over an inch. A scale from the region mentioned by Putnam is similar to that of *ayassizi*, but with 5 or 6 concentric lines and 3 radiating furrows.

The specimen thus agrees with *cornutus* in position of eye and plan of markings, with *agassizi* in length of pectorals and structure of scales, is intermediate in length of head, and agrees with neither in color of caudal and dorsal and tint of middle band. (*Forbes*, in lit. November 4, 1880.)

# FAMILY XLIX.—CYPRINODONTIDÆ.

(The Cyprinodonts.)

Body oblong or moderately elongate, compressed behind, depressed forwards, covered with rather large cycloid scales, which are adherent and regularly arranged. No lateral line. Head scaly, at least above. Mouth terminal, small, the lower jaw usually projecting; margin of the upper jaw formed by the premaxillaries only; premaxillaries strong, extremely protractile. Teeth incisor-like or villiform, sometimes present on the vomer, but usually in the jaws only; lower pharyngeals separate, with cardiform teeth. Gill-membranes somewhat connected, free from isthmus; gill-rakers very short, thick. Branchiostegals 4-6. Pseudobranchiæ none. Dorsal fin single, inserted posteriorly, of soft rays only, rarely with a single spine or a rudimentary spinous dorsal; candal fin not forked; ventral fins abdominal, rarely wanting; pectoral fins inserted low; no adipose fin. Stomach not eccal, without pyloric appendages. Air-bladder simple, often wanting. Sexes usually unlike, the fins being largest in the males. Most or all are ovoviviparous, the young well developed at time of birth. Fresh-water fishes of Southern Europe, Asia, Africa, and America, some of them occurring in bays and arms of the sea. They are mostly of small size, and the species are very difficult of determination. Genera 30; species about 140.

(Cyprinodontidæ Günther, vi, 299-356.)

Note.—In the following analysis the genera known from Mexico are also included, their names being placed in *italics*.

- \* Intestinal canal comparatively short, little convoluted; teeth mostly fixed; dentary bones firmly joined. (Carnivora.)
  - a. Anal fin of the male not modified into an intromittent organ.
    - b. Teeth incisor-like, notched; insertion of dorsal nearly opposite ventrals. (Cyprinodontina.)
      - c. Teeth in a single series; body short and deep.
        - d. Dorsal very long, with 16-18 rays, the first spine-like...Jordanella, 156. dd. Dorsal short, of 10-11 rays, the first ray small.........Cyprinodon, 157.

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bb. Teeth all pointed: ventrals present. (Funduling.)
        e. Teeth in more than one series; air-bladder present.
          f. Dorsal fin comparatively large and well forward, its rays usually more
                             than 11 and the first ray usually in front of the
                             anal.....Fundulus, 158.
          ff. Dorsal fin small and posteriorly placed, its rays usually 7-10, and the
                             first ray generally behind the front of the anal.
           cc. Teeth in one series; dorsal fin in advance of anal.
             h. Dorsal and anal fins short, each with 9-13 rays.....LUCANIA, 160.
             hh. Dorsal and anal fins long, each with more than 20 rays.
                                                           Girardinichthus.
 aa. Anal fin of the male advanced, modified into a sword-shaped, intromittent
                             organ. (.1nablepiuw.)
               i. Eve normal (i. e., not divided into two portions by a horizontal
                             partition); teeth in bands.
                j. Jaws not produced.
                  ** Intestinal canal elongate, with numerous convolutions; anal fin in the male usually
                             modified into an intromittent organ; dentary bones
                             loosely joined; teeth movable, (Limnophage,)
                    1. Teeth all pointed. (Pacilina.)
                      m. Teeth in more than one row: dorsal more or less in
                             advance of the anal, greatly enlarged in the male.
                        n. Caudal fin in the male with its lower lobe much pro-
                             duced; dorsal fin long, of 12 or more rays.
                                                             Xiphophorus.
                        nn. Candal fin normal, alike in the two sexes.
                          o. Dorsal fin long, of more than 12 rays.
                                                        Mollienesia, 162.
                          oo. Dorsal fin short, of less than 12 rays.. Pecilia, 163.
                      mm. Teeth in a single series; dorsal fin short,
                           p. Dorsal inserted in advance of anal.
                                                              Platypæcilus.
                           pp. Dorsal inserted posteriorly to anal.
                                                         GIRARDINUS, 164.
                     ll. Teeth incisor-like, tricuspid (Goodeina)...........Goodea.
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#### 156.-JORDANELLA Goode & Bean.

(Goode & Bean, Proc. U. S. Nat Mus. ii, 177, 1879; type Jordanella florida G. & B.)

Body short, deep, compressed. Head short. Mouth small, very protractile, the lower jaw the longer; lips full. Jaws each with a single series of rather broad, wedge-shaped, incisor teeth, the cutting edge of which is deeply notched, usually trifid. Branchiostegals 5. Dorsal fin elongate, the number of rays 16-18, the first being a robust spine; insertion of dorsal fin behind ventrals, in advance of front of anal, its last ray behind the last of anal; dorsal fin not greatly elevated. Anal fin shorter and smaller, similar in both sexes; ventral fins small, with a scale at base; caudal fin rounded; pectorals short and small. Intestinal canal rather long; three times length of body. Sexes similar. (Dedicated to David S. Jordan.)

#### 524. J. floridge Goode & Bean.

Body ovate, short and deep, with elevated back, deep candal peduncle, and steep profile. Head moderate, flat and broad between the eyes, its profile less steep than that of the back. Eyes large, 33-4 in Mouth small, anterior, the lower jaw projecting. Scales moderate, the humeral scale not much enlarged. Dorsal fin inserted midway between snout and base of candal, its first ray robust and spinelike, grooved behind, lorger than the diameter of the eye, and about as high as the succeeding soft rays. Fins all rather low, the ventrals reaching just past the vent. Scales with strong concentric striæ. Color olivaceons; sides orange or brassy, with a broad steely-blue stripe along each series of scales; 4 or 5 vague, diffuse, black vertical bars, most distinct in the young, nearly obsolete in the adult; a large, diffuse, dusky blotch on the sides, below the dorsal spine; fins mostly dark, the dorsal barred or speckled in the males, nearly plain in the females, sometimes a dusky blotch on its last rays; body and fins everywhere finely punctulate with black; a dark bar below eye. Head 31; depth 2-21. D. I, 16, or I, 17; A. I, 11, to I, 13; Lat. l. 25-27; L. transv. 11 or 12. L. 11 inches. Streams of Central and Eastern Florida; abundant. The above description from specimens taken by Dr. J. A. Henshall in San Sebastian River. The original types were from Lake Monroe. Herbivorous, at least in part.

(Goode & Bean, Proc. U. S. Nat. Mus. ii, 117, 1879.)

#### 157.—CYPRINODON Lacépède.

(Lebias Cuvier.)

(Lacépède, Hist. Nat. Poiss. v, 486, 1803: type Cyprinodon variegatus Lac.)

Body very short and stout, the back somewhat elevated. Mouth small. Snout short. Teeth moderate, incisor-like, tricuspid, in a single series. Scales very large; humeral scales usually enlarged. Dorsal fin moderate, inserted in advance of front of anal; its first ray not enlarged; anal smaller; ventral flus small. Intestinal canal little longer than body. Gill-membranes considerably united, free from the isthmus. Chubby little fishes, inhabiting the brackish waters of America, Southern Europe, and Northern Africa; sometimes living in hot salt springs. (zôπρινος, carp; δ∂ῶν, tooth.)

#### 525. C. variegatus Lac.

Body short and deep, the back considerably arched. Mouth as in the others, small and terminal. Humeral scale 4 times the size of the others. Eye longer than snout,  $3\frac{1}{2}$  in head, less than interorbital space. Origin of dorsal about midway of body, behind ventrals in old specimens, rather in advance in the young; males with the dorsal fin elevated, but not reaching, when depressed, nearly to caudal. Male fish dusky, with only traces of bars; caudal fin with a dusky bar at base and on posterior edge; tips of dorsal and anal dusky; the scales in the breeding season with small tubercles. Female olivaceous; sides silvery, with darker bars and irregular markings; a dark bar at base of caudal; a dark spot on posterior part of dorsal. Head  $3\frac{1}{4}$ ; depth  $2\frac{1}{4}$ . D. 10; A. 10; scales 25; L. transv. 11. L. 3  $2\frac{1}{2}$  inches;  $2\frac{1}{2}$  inches. Cape Cod to Mexico, in brackish waters, entering streams.

(Lacépède, Hist. Nat. Poiss, v. 486: Lebias orinus DeKay, New York Fauna, Fish. 215; Günther, vi, 305: Cyprinodon bovinus B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 589: Cyprinodon bovinus Girard, U. S. Mex. Bound. Surv. Ichth. 67: Cyprinodon bovinus Günther, vi, 307: Cyprinodon eximius Girard, Proc. Acad. Nat. Sci. Phila. 1859, 158.)

#### 526. C. gibbosus Baird & Girard.

Similar to the preceding, but the body still deeper and the back and fins still more elevated; the scales apparently somewhat smaller; anal much smaller than dorsal; coloration similar to that of *C. variegatus*. Head  $2\frac{3}{4}$ ; depth  $1\frac{3}{4}$ . D. 10; A. 11; Lat. l. 28; L. transv. 14. Indianola, Texas. (*Girard*.)

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 390; Girard, U. S. Mex. Bound, Surv. Ichth. 67.)

#### 527. C. Intifasciatus Garman.

Form and dentition of *C. gibbosus*. Black caudal band much wider; a light band from middle of opercle to lower half of caudal; a dark band above this, separated by a narrower band of light from the dark olive of the back; silvery color of belly separated from the light band on the flanks by a short band of brown; fins clouded with brown; caudal with a narrow dark band across its base and a broad one across its extremity. Head 4 in total length; depth 3. D. 12; A. 11; V. 6; P. 14; Lat. l. 30; L. transv. 11. Parras, Coahnila, Mex. (*Garman*.)

(Garman, Bull. Mus. Comp. Zoöl. viii, No. 3, 92, 1881.)

### 528. C. elegans Baird & Girard.

Body more clongate than in any of the preceding; the upper outline of the head less depressed, so that the profile is continuous; fins low, the dorsal quite small; its rays scarcely extending to the beginning of the candal peduncle. Bluish black, sides somewhat variegated with darker, the males somewhat spotted; edge of caudal fin black in the male; a black patch on last rays of dorsal in the female. Head  $3\frac{1}{2}$ ; depth 2 to 3. D. 11;  $\Lambda$ . 10; scales 26-12. L.  $2\frac{1}{2}$  inches. Rio Grande. (Girard.)

(Baird & Girard, Proc. Acad. Nat. Sci. Phila, 1853, 389; Girard, U. S. Mex. Bound, Surv. Johth. 63.)

#### 529. C. californicusis Grd.

"It may be easily distinguished from its congeners in North America." by its uniform system of coloration which exhibits neither bands nor spots. The general aspect of its body is rather short and deep, except in the young which assume a subfusiform appearance. The largest specimens which we have examined measure about an inch and a half in total length. The head constitutes the fourth of the length, the snort being abruptly rounded off. The mouth is, proportionally speaking, of medium size, whilst the eye is rather small, subcircular; its diameter entering three times and a half in the length of the side of the head. The dorsal fin is higher than long, and superiorly convex; its interior margin being nearer the apex of the snout than the posterior margin of the caudal. The anal fin is nearly as large as the dorsal, deeper than long, inferiorly convex, particularly upon its posterior half. The caudal is posteriorly truncated, nearly linear. The ventrals are small, project beyond the vent and reach almost the origin of the anal. The pectorals are well developed, rounded off, extending as far as a vertical line drawn at the insertion of the ventrals. The rays are: D. 10 + 1; A. 11; C. 3, 1, 8, 8, 1, 3; V. 7; P. 12. The scales are much deeper than long, anteriorly truncated and posteriorly rounded off or convex. The color is olivaceous brown, with a dark grayish tint along the back, and a golden tint beneath." (Girard.) San Diego, California.

(Grd. Proc. Acad. Nat. Sci. Phila, 1859, 157.)

#### 530. C. macularius Baird & Girard.

Apparently very similar to C. variegatus; the female dark above, with dark bars on the sides and a dark shade across the dorsal fin; fins rather small. Head  $3\frac{3}{3}$ ; depth  $2-2\frac{1}{2}$ . D. 10; A. 11; scales 26-9. L. 2 inches. Rio Gila. (Girard.)

(B. & G. Proc. Acad. Nat. Sci. Phila, 1853, 389; Girard, U. S. Mex. Bound. Surv. Ichtb. 68.)

#### 531. C. carpio Giinther.

Slenderer than *C. variegatus*; humeral scale scarcely larger than the others; dorsal fin inserted slightly behind ventrals; eye 3½ in head, a

little shorter than snont; olivaceous, silvery below. Head 3; depth 2½. D. 11; A. 10; scales 25–10. "America." (Günther.)

(Günther. vi. 306.)

#### 158.-FUNDULUS Lacépède.

### Killifishes.

(Hydrargyra Lacépède: Xenisma Jordan.)

(Lacépède, Hist. Nat. Poiss. v, 37, 1803: type Fundulus mudfish Lacépède = Cobitis heteroclita L.)

Body rather elongate, little elevated, compressed behind. Mouth moderate. Jaws, each with two or more series of pointed teeth, usually forming a narrow band. Bones of the mandiole firmly united. Scales moderate. Branchiostegals 4-6. Preopercle, preorbital, and mandible with mucous pores. Dorsal and anal fins similar, moderately developed or rather large, the dorsal usually inserted in front of the anal. Ventrals well developed. Air-bladder present. Sexes differing in color, size, and development of the fins, the anal fin in the male normal. Intestinal canal short. Species very numerous, mostly American, inhabiting fresh waters and arms of the sea. They are the largest in size of the Cyprinodonts, and some of them are very brightly colored. (Latin fundus, bottom, the supposed abode of the "Fundulus mudfish.")

The species may be divided as follows:

and the deal may be divided the
* Dorsal fin beginning in advance of anal.
t Branchiostegals 6. (Hydrargyra Lacépède.)
a. Males with dark cross-bars and a black dorsal spot; females with longitudinal stripes
aa. Males and females with dark cross-barssimilis, zebra.
aua. Males without sharp markings, the scales rough in spring; females plaiu. parvipinuis.
tt Branchiostegals 5. (Fundulus.)
b. Dorsal long, its rays 16 or 17; body with round black spots, at least in the male
bb. Dorsal moderate, its rays 10-14.
c. Scales rather small, 40 or more in a longitudinal series.
d. Cross-bars if present, blackdiaphanus, confluentus.
dd. Cross-bars silvery.
e. Teeth small, in a bandmenona.
cc. Teeth in about two series, the outer enlargedadinia.
cc. Scales large, less than 40 in a longitudinal series.

gg. Branchiostegals 4; spots irregular ......stellifer.

- \* Dorsal fin beginning in advance of anal.
  - † Branchiostegals 6. (Hydrargyra \* Lacépède.)
    - a Males with dark cross-bars; females with longitudinal stripes.

### 532. F. majalis (Walb.) Gthr.—Killifish; Mayfish; Rockfish.

Body oblong, scarcely elevated, little compressed; head rather prolonged anteriorly, the mouth small, terminal and very oblique; scales rather large; dorsal fin moderate; anal fin very high in the males, moderate in the females; ventrals long in the males, reaching past front of anal; eve moderate, shorter than shout and than interorbital space; a slight angle formed by the profile, in front of the eye, due to the greater flattening of the snout. Male fishes dark olivaceous above; sides silvery or somewhat golden, with about a dozen broad transverse bars of the color of the back: posterior part of dorsal fin with a black patch; fins yellowish or pale. Females olivaceous above, white below, a narrow black band along sides about on the level of the eye and as wide as the pupil; below this two similar black bars anteriorly and one posteriorly, the upper one being interrupted; one or two black bars at base of candal. Females usually larger than the males. A large specimen taken at Beaufort, N. C., supposed to be a male of this species in high coloration, showed the following colors in life: Back olive, sides and belly bright salmon yellow; lower fins clear yellow; pectorals and anal with some dusky: posterior edge of candal dark; dorsal nearly all black, a large black occilated spot on the last rays; opercles and under parts of head with an inky suffusion; cheeks, top of head, and mouth bronze yellow; sides with about 18 narrow dusky vertical bars. Teeth in a broad band; an onter row of rather large teeth. Oviduct aduate to first anal ray for Head  $3\frac{3}{4}$ ; depth 4. D. 12; A. 10; Lat. 1. 36; L. a short distance. transv. 13. L. 5-6 inches. Cape Cod to Florida, the largest of our Currinodontida: abundant in shallow bays.

(Cobitis majalis Walbaum, Artedi, Pisc. 12, 1792: Esox flavulus Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 439; Günther, vi, 322: Hydrargyra majalis C. & V. xviii, 207.)

### 533. F. swampinus (Lac.) Gthr.

Very similar to the preceding, but the scales apparently somewhat smaller; greenish olive, with a silvery longitudinal band, and 12-15 blackish vertical streaks. Head 4; depth 4½. B. 6; D. 14; A. 12; Lat. I. 43. South Carolina. (*Val.*)

(Hydrargira swampina Lacépède, Hist. Nat. Poiss. v, 378; Giinther, vi, 323.)

<sup>\*</sup> Lacépède, Hist. Nat. Poiss. v, 378, 1803: type Hydrargira swampina Lac. (ύδορ, water; ἀργυρος, silver.)

and Males and females with dark cross-bars.

#### 534. F. similis (Baird & Girard) Gthr.

Body moderately elongate. Head rather pointed and elongate, as in *F. majalis*. Sexes similarly colored; both olivaceous above; the sides silvery, with 10–15 dark vertical bars; males with an occllated spot on the last rays of dorsal. Ventral fins short; insertion of dorsal midway between front of orbit and end of caudal. Head  $3_3^1$ ; depth 4. D. 11; A. 8 or 9; Lat. l. 33; L. transv. 13. Coast of Texas, ascending streams.

(H<sub>2</sub>drargyra similis Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 389: Hydrargyra similis Girard, U. S. Mex. Bound. Ichth. 68: Fundulus similis Günther, vi, 323; Jordan, Bull. U. S. Geol. Surv. Terr. iv, 400.)

### 535. F. zebra (Girard) Gthr.

Body elongate, compressed, subfusiform, the back slightly arched. Head subpyramidal, very much depressed. Eye 4 in head. Fins moderate; higher in the males than in the females. Scales smaller than in *F. similis* and more closely imbricated. Olivaceous above, with a blackish spot upon each scale; sides yellowish, with narrow transverse black bands or bars, about 16 in number, more conspicuous in the males than in the females, and extending from the back to the belly; interspaces wider than the dark bars. Fins plain. Sexes similar. Head 34. D. 13; A. 14. L. 3 inches. Rio Grande in New Mexico. (*Girard.*) (*Hydrargyra zebra* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 60; Günther, vi, 324. Not of Dekay.)

aaa. Males without sharp markings; scales rough in spring. Females nearly plain.

#### 536. F. parvipinmis Grard.

Male, light olive green, mottled with darker; sides with silvery and brassy lustre; lower parts yellow; about 20 short blackish cross-bars along middle of sides, broader, plainer, and more closely set behind; sides and fins with dark points; upper fins dull olive; lower yellow. Female larger, olive green above, sides not barred, with an obscure dusky lateral band on caudal peduncle. Fins plain. Fins very high in the male, small in the female. Scales large; in the males in spring roughened or ctenoid by small granulations and prickles, similar to the nuptial excrescences of some *Cyprinidæ*; fins also rough. Oviduet forming a sheath at base of first ray of anal. Head  $3\frac{1}{2}$ ; depth  $3\frac{3}{3}$ . D. 13; A. 11; Lat. I. 38; L. transv. 12. L. 4 inches. Coast of California from Point Concepcion southward; very abundant in bays and lagoons.

(Girard, Proc. Acad. Nat. Sci. Phila, 1854, 154; Girard, U. S. Pac. R. R. Surv. x, 303; Günther, vi, 319; Steindachner Ichth. Beiträge, v, 155, 1876.)

tt Branchiostegals 5. (Fundulus.)

b. Dorsal long; its rays 16 or 17.

#### 537. F. seminolis Girard.

Body rather stout. Head subpyramidal, the snout tapering. Eye  $4\frac{1}{2}$  in head. Dorsal fin high, its origin nearer apex of snout than origin of candal; anal deeper than long. Ventrals not reaching vent. Scales deeper than long, of moderate size. Dark brown with large round black spots, the spots corresponding to the scales, upon their line of intersection. Dorsal and candal spotted. Head  $3\frac{1}{3}$ ; depth  $3\frac{1}{3}$ . D. 17; A. 13; V. 6. Florida. (Girard.)

(Girard, Proc. Acad. Nat. Sci. Phila, 1859, 59; Günther, vi. 325.)

- bb. Dorsal moderate, its rays 11-14.
  - c. Scales rather small; more than 40 in a longitudinal series.
    - d. Cross-bars blackish.

#### 538. F. diaphanus (Le S.) Ag.—Spring Minnow.

Body rather slender, not elevated, compressed posteriorly. Head moderate; quite flat above. Fins not large; dorsal and anal rather low; ventrals searcely reaching vent in the females; somewhat longer in the males. General color olivaceous; sides silvery; 15–25 narrow, irregular blackish cross-bars on the sides; back always more or less spotted with blackish; fins nearly plain. Teeth pointed, the outer not much enlarged. Head 4; depth 4<sup>4</sup>/<sub>5</sub>. Eye large, 3½ in head. D. 13; A. 11; Lat. l. 40; L. transv. 12. L. 4 inches. Coasts, ascending all streams to their fountain heads. Abundant in various tributaries of the great lakes, Upper Mississippi, west to Colorado, and in ponds and streams of the Middle and Eastern States.

(Hydrargyra diaphana Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 1817, 130: Hydrargyra multifasciata Le Sucur l. c. 131: Fundulus multifasciatus Günther, vi, 324, and of most writers; Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 67.)

#### 539. F. confinentus Goode & Bean.

Yellowish, with a longitudinal streak along each row of scales and about 14 distinct irregular vertical dark bands. Head low, flat. Snont not produced. Interorbital space 2 in length of head, eye 4 in head. Origin of dorsal midway between tip of caudal and middle of eye. First ray of anal under second of dorsal. Anal higher than long. Scales crowded. B. probably 5. Head 3½; depth 3½. D. 10; A. 10; Lat. I. 45. Lake Monroe, Florida. (Goode & Bean.)

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 118.)

- dd. Cross-bars silvery.
  - e. Teeth in bands, the outer not enlarged

### 540. F. menona Jordan & Copeland.

Body elongate, slightly compressed, not elevated; head long and large, rather narrow above, the interorbital space half wider than eye, which is 4 in head. Dorsal moderate, inserted in advance of the anal, which is short and deep; paired fins short; vent midway between eye and base of candal. Color (3) dark olive brown, with about 16 shining, silvery, vertical bands, which are narrower than the dark interspaces; the interspaces broadest behind; fins plain; teeth pointed, curved, onter little enlarged. Head 3\(\frac{2}{3}\); depth 5. D. 12; A. 10; B. 5; scales 48-12. L. 3\(\frac{1}{3}\) inches. Rock River, Wisconsin.

(Jordan & Copeland, Proc. Acad. Nat. Sci. Phila, 1877, 68.)

ce. Teeth in about two series, the outer enlarged.

#### **541. F. adinia** J. & G. nom. sp. nov.

Body short, deep, and compressed; head moderate, broad, and flat above, the interorbital space rather more than half greater than the width of the eye; eye 4 in head; dorsal and anal fins rather large; dorsal inserted almost exactly over front of anal; teeth mostly in two series, the outer very strong; vent midway between eye and base of caudal; scales small, closely imbricated. Color olivaceous, with 15 to 20 silver cross-bars, almost as wide as the interspaces posteriorly, wider than the interspaces anteriorly, extending over the belly and joining their fellows on the opposite side; the bands variable, but usually wider and more crowded than in *F. menona*; fins plain. Head 3\frac{3}{3}; depth 4. D. 13; A. 11; scales 44-15. L. 2 inches. Coast of Texas, ascending streams; our specimens from the Rio Grande.

(? Adinia multifasciata Girard, Proc. Acad. Nat. Sci. Phila. 1859, 117: Fundulus zebra Jordan, Bull. U. S. Geol. Surv. Terr. iv, No. 2, 1878, 664. Not Hydrargyra multifasciata Le Sueur, nor Hydrargyra zebra Grd., nor Fundulus zebra Dekay.)

- cc. Scales rather large, less than 40 in a longitudinal series.
  - f. Males with 9 or 10 silvery cross-bars; females with black vertical stripes; fins plain.

### 542. F. migrofasciatus (Le S.) C. & V.

Body rather short and deep; head rather long and depressed; the snout obtuse, a slight angle being formed above the eye; dorsal moderate, well back; anal short and deep; eye longer than snout, 1½ in interorbital space, 3½ in head. Olivaceons above, silvery below; fins in both sexes immaculate; males with 9 or 10 very distinct silvery

eross-bars, each about as broad as a scale; females with about as many narrow black bars, which do not extend on the back or belly; scales punctate. Head  $3\frac{2}{3}$ ; depth 4. D. 11; A. 9; scales 33–11. L.  $2\frac{1}{2}$  inches. (Günther.) Atlantic coast of United States, not very common.

(Hydrargyra nigrofusciata Le Suenr, Jonrn. Acad. Nat. Sei. Phila. 1817, i, 133; Storer, Fish Mass, 295; Günther, vi, 325.)

ff. Males with silvery spots and bars; females nearly plain olivaceous; fins spotted.

# **543. F. heteroclitus** (L.) Günther.—Common Killifish; Mammichog; Salt-water Minnow.

Body thick-set, short and deep; anteriorly broad, posteriorly compressed, the back elevated; head rather short, bluut, broad and flat on ton; eve moderate, about equal to snout, about half the width of interorbital space and one-fifth of the length of the head; fins moderate, the dorsal inserted in males midway between snout and tip of candal; in females farther back; oviduct attached to anterior ray of anal fin, its opening near the tip of the ray; teeth in broad bands, pointed, the outer series enlarged. Coloration in males dark dull green, the belly more or less orange vellow; sides with numerous quite narrow illdefined silvery bars made up of spots, most distinct posteriorly; besides these are numerous conspicuous white or yellow spots, irregularly scattered; vertical fins dark, with numerous small round pale spots; dorsal often with a blackish spot on its last ray; anal and ventrals vellow anteriorly; under side of head yellow; young males sometimes with dark bars. Females nearly plain olivaceous, tighter below, without spots or bars, the scales finely punctate; sides sometimes with a few faint vertical shades. Head  $3\frac{3}{3}$ ; depth  $3\frac{3}{3}$ . D. 11; A. 11; scales 36-13; L. 3-5 inches. Maine to Mexico, everywhere very common in brackish waters, the most abundant of our Cyprinodontide. Southern specimens perhaps reach a larger size (var. grandis) than northern, and some specimens (var. pisculentus) have the head wider than usual.

(Cobitis heteroclita L. Syst. Nat.: Esox pisculentus, Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 441 · Fundulus pisculentus of most American authors: Fundulus zebra Dekay, N. Y. Fauna, Fish. 218, 1842; Fundulus grandis Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 389; Fundulus grandis Girard, U. S. Mex. Bound. Surv. Ichth. 69; Fundulus floridensis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 157; Fundulus pisculentus Storer, Fish. Mass. 294; Günther, Cat. Fish. Brit. Mus. vi, 318.)

<sup>\*\*</sup> Dorsal fin beginning directly above or slightly behind anal. (Xenisma\* Jor.)

<sup>\*</sup> Jordan, Bull. Buff. Soc. Nat. Hist. 1876, 142: type Xenisma stellifera Jor. ( $\xi \acute{\epsilon} \nu \iota \acute{\sigma} \mu \alpha$ , a surprise.)

q. Branchiostegals 5; spots in regular series.

### 544. F. catenatus (Storer) Gthr.—Stud-fish.

Similar in form to *F. stellifer*, but larger, with lower fins and different coloration; dorsal and anal fins even in the males, falling short of the candal; color bluish or greenish, with a round orange spot (in the male) on each scale, thus forming series of regular lines of dots; females with smaller brown spots on the scales, also forming lines. Anal prickly in spring males. Teeth in broad bands, the outer somewhat enlarged. Head 4; depth 4½–5. D. 14; A. 15; Lat. l. 50. L. 6 or 7 inches. Tennessee and Camberland Rivers, locally abundant, one of the largest and handsomest of the Cyprinodonts.

(Pacilia catenata Storer, Synopsis Fish N. A. 1846, 430; Günther, vi, 322; Cope, Journ. Acad. Nat. Sci. Phila. 1868, 238; Xenisma catenata Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 322.)

gg. Branchiostegals 4; spots irregular.

#### 545. F. stellifer Jordan.—Spotted Stud-fish.

Body rather long, somewhat compressed. Head broad and flattened above, in the usual fashion. Eve large, about 4 in head. Scales closely imbricated, deeper than long. Dorsal fin beginning slightly behind anal, its last rays in the adult males highly elevated, reaching the base of candal, their height equal to the depth of the body; anal similar, more elevated in front and less so behind, the last rays falling just short of caudal; fins lower in females and young; pectorals reaching ventrals, the latter to anal in the males. Teeth in a narrow band, the outer somewhat enlarged, blunt and curved. Coloration brilliant; livid blue above, somewhat silvery below; body and cheeks, with large, bright dark orange spots, irregularly placed, not following the rows of scales, and not always in the middle of the scales; these spots not uniform in size; females with olive-brown spots horizontally, oblong and smaller than the orange spots of the males and more regularly placed; a blue loral blotch, with a green one below it; a pale yellow blotch on the back in front of the dorsal, very conspicuous when the first anal ray. Head 33; depth 5. D. 13; A. 13; V. 6; Lat. l. 53. L. fish is in the water, but fading in spirits. Ovidnet not extending on 3-4 inches. Alabama River, in clear streams and springs; a beautiful fish.

(Xenisma stellifera Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 322.)

Bull, Nat. Mus. No. 16——22

### 159.—ZYGONECTES Agassiz.

Top Minnows.

(Micristius Gill.)

(Agassiz, Am. Journ. Sci. Arts, 1854, 135: type Pacilia olivacea Storer.)

This genus is closely related to Fundulus, differing chiefly in the small size and posterior position of the dorsal, which has usually less than ten rays and is commonly inserted behind the front of the anal fin. The species are smaller in size than those of Fundulus, and different in appearance, so that we feel reluctant to unite the two genera, although the technical differences are very slight. From the Old World genus Haplochilus, Zygonectes is distinguished by the short anal fin. The females of Zygonectes are scarcely distinguishable from those of Gambusia. Species all American. Surface swimmers, feeding upon insects.

( $\tilde{\zeta}\tilde{\nu}\gamma\delta\nu$ , yoke:  $\nu\tilde{\eta}\kappa\tau\eta\varsigma$ , swimmer; they being said to swim in pairs.)

#### 546. Z. Pubrifrons Jordan.

Body moderately stout, little compressed, not elevated, the caudal peduncle deep; head rather long, broad between the eyes, flat above; eyes large, 31 in head, their range horizontal; mouth rather large. Teeth small, nearly even, in a narrow band. Scales moderate. Dorsal fin very short and small, placed a little behind the anal or about even with it, its position in the males rather more posterior; anal short, high in the males; ventrals very small; pectorals small. Color, males dark olivaceous, with a dark, bronze-orange spot on each scale posteriorly, much as in Fundulus catenatus. Below, these spots are bright orange. Faint, narrow vertical, orange bars along the lower and posterior part of the body. Vertical fins with orange spots. Jaws and space in front of eyes bright orange-red; paired fins dusky. Females almost uniform brassy-olivaceous, without evident spots or red markings. Head 31 in length to base of caudal; depth  $3\frac{3}{3}$ . D. 7 or 8; A. 8 or 9; Lat. 1. 32; L. transv. 11 or 12; B. 5. L. 23-3 inches. San Sebastian River, Florida, a larger species than most in the genus, and with the dorsal fin less posterior.

(Jordan, Proc. U. S. Nat. Mus. 1879, 237.)

#### 547. Z. henshalli Jordan.

Body rather stout, deep and compressed, the profile nearly straight, the back little elevated, and the caudal peduncle deep; head moderate;

<sup>\*</sup> Body rather elongate. (Zygonectes.)

a. Sides without black band.

mouth rather large; jaws each with a series of long and rather slender canine-like teeth, behind which is a band of small teeth; the canines larger in the lower jaw; eye large; scales rather large; dorsal fin short and high, inserted slightly behind the anal in the males, exactly opposite it in the females; caudal large; anal fin larger and rather lower than dorsal; ventrals quite small; pectorals moderate. General color olivaceous; sides covered, especially posteriorly, with rather large, irregularly placed orange spots, which also extend on the vertical fins; dorsal dusky, with a dark bar; head without red; caudal and anal more or less yellow; females obscurely marked; young with diffuse greenish vertical bars. Head  $3\frac{1}{2}$  in length to base of caudal; depth 4. B. 5; D. 7 or 8; A. 10 or 11; Lat. l. 33; L. transv. 10. L. 3–4 inches. San Sebastian River, Florida. The largest species of the genus, looking like a Fundulus.

(Jordan, Proc. U. S. Nat. Mus. 1879, 327.)

### 548. Z. floripinmis (Cope) Jor.

General form of Z. notatus; lower jaw somewhat projecting; external series of teeth in both jaws enlarged; eye large,  $3\frac{1}{5}$  in head. Olive gray, scales with ochre borders; fins yellow, broadly edged with crimson. Head  $4\frac{1}{8}$ ; depth 5. D. 10; A. 13; scales 29–10. L.  $2\frac{1}{2}$  inches. Rivers of Colorado. (Cope.)

(Haplochilus floripinuis Cope, Zoöl, Lieut, Wheeler's Expl. W. 100th Mer. v, 695, 1876.

### 549. Z. limeatus Garman.

Brownish, finely punctulate with brown; white below; lips, top of head, and a line along middle of back dark; tail with faint transverse bands. Moderately stout, compressed. Crown flat. Eye large, as long as snout, 1\frac{3}{4} in interorbital width. Lower jaw slightly longer. Outer teeth long, slender, curved. First ray of dorsal almost opposite first of anal, one-third the distance from base of caudal to front of eye; caudal truncate. Head nearly 3; depth 4\frac{1}{4}. D. 11; A. 14; V. 6; P. 15; Lat. l. 36; L. transv. 12. Northeastern Wyoming. (Garman.)

(Garman, Bull. Mus. Zoöl. viii, No. 3, 88, 1881.)

aa. Sides with a broad, dark lateral band; fins plain or speekled.

#### 550. Z. notatus (Raf.) Jor .- Top Minnow.

Body rather slender, compressed behind. Head low, depressed, and rather elongate, the snout somewhat produced, the lower jaw scarcely projecting; interorbital space broad, its width about half length of head; eye large, less than snout, about 3 in head. Fins moderate, the

dorsal and anal elevated in the males. Teeth in a broad band, the outer series considerably enlarged and canine-like. Coloration brownish olive, with a broad, dark purplish-black lateral band running from tip of snout through eye to base of caudal; darker in males than in females; young specimens have the edges of the band serrated; a few series of small black dots along the sides of the back; dorsal, caudal, and anal fins dotted with black; top of head with a conspicuous translucent spot in life; concentric striæ on scales, strong. Head 4; depth 4½. D. 9; A. 11; scales 34-11. L. 2-3½ inches. Michigan to Alabama and Texas, generally abundant in ponds and canals.

(Semotilus? notatus Raf. Ich. Oh. 1820, 83: Pacilia olivacea Storer, Synopsis, 178: Fundulus tenellus B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 389: Zygonectes pulchellus Girard, Proc. Acad. Nat. Sci. Phila. 1859, 60: Fundulus aureus Cope, Proc. Acad. Nat. Sci. Phila. 1855, 78: Haplochilus pulchellus Günther, vi, 314: Haplochilus aureus Günther, vi, 315: Jordan, Man. Vert. 264.)

\*\* Body short and deep. (Micristius Gill.)

#### 551. Z. atribatus Jordan & Brayton.

Body short and stout, compressed, especially posteriorly. Head moderate, broad and flattened above. Dorsal fin well back, moderately high; anal fin rather larger; paired fins small. Coloration dull olive; no stripes or bars; seales slightly dark-edged; a large jet-black blotch on each side just above and somewhat in front of the vent, due to the black peritoneum showing through the translucent sides; dorsal and anal fins speckled. Teeth small, the outer little enlarged. Head 4; depth 4. D. 8; A. 8; scales 30. L. 1<sup>3</sup>/<sub>4</sub> inches. Neuse River, North Carolina.

(Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 1878, 84.)

#### 552. Z. melanops (Cope) Jor.

Body rather short and deep. Head broad; eye as long as snout,  $3\frac{1}{2}$  in head, 2 in interorbital width; teeth in a band, the outer series scarcely enlarged. Fins short. Yellowish brown; scales darker edged; body without distinct longitudinal stripes or bars; belly golden; a very conspicuous jet-black spot just below the eye, and confluent with it in the adult; dorsal and caudal fins with series of black dots; caudal very large. Head  $3\frac{1}{3}$ ; depth  $3\frac{1}{2}$ . D. 7; A. 9; scales 28–7. L.  $2\frac{1}{2}$  inches. Neuse River (Cope) to Southern Illinois (Forbes) and Mississippi (Hay), locally abundant.

(Haplochilus melanops Cope, Proc. Amer. Phil. Soc. 1870, 457; Jordan, Bull. Ill. Lab. Nat. Hist. ii, 52, 1878; Hay, Proc. U. S. Nat. Mus. 1880, 501.)

#### 553. Z. dispar \* Agassiz.

Body short and deep, much compressed. Head short and very broad, the flat interorbital space being two-thirds of its length, and barely twice the diameter of the eye; the distance between the eyes above greater than the distance between them below. Snout broadly rounded. Fins moderate; dorsal much smaller than anal. Outer series of teeth somewhat enlarged. Coloration pale olive, bluish in life; a very distinct brownish line along the edges of each row of scales, appearing wavy or serrated as it follows the scales; about 10 of these longitudinal stripes are present; males with the lines interrupted, appearing as series of dots and further marked by about 9 dark cross-bars; adults with a dark blotch below the eye, sometimes confluent with it. Oviduct free from anal. Head  $3\frac{3}{4}$ ; depth  $3\frac{1}{2}$ . D. 7; A. 9; scales 35–10. L.  $2\frac{1}{2}$  inches. Lakes and sluggish streams from Ohio to Iowa.

(Agassiz, Amer. Jour. Sci. Arts, 1854, 353; Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 67.)

### 554. Z. brachypterus Cope.

"Base of the first dorsal ray behind the vertical line equally dividing the base of the anal; ventrals not reaching base of anal. Scales large. Head wide, with overhanging supercilia; interorbital width twice the diameter of the orbit, which enters the length of the head  $2\frac{1}{2}$  times. Color uniform olivaceous, the scales with brown edges; cheeks silvery; no spots on the head. Body stout. Head  $4\frac{1}{2}$ . D. 7; A. 8. Scales 30–9. Length 2." (Cope, MSS.) Trinity River and other streams in Texas.

<sup>\*</sup>Professor Agassiz, Amer. Journ. Sci. Arts, 1854, 353, mentions three more species of this genus, which have not since been recognized, besides two (Z. lateralis and Z. zonatus) which are evidently identical with Z. notatus, and another, Z. lineolatus, which Professor Putnam informs us is identical with Z. nottii.

Z. nottii Agass.

<sup>&</sup>quot;The darker continuous longitudinal lines alternate with fainter interrupted ones. Males with distinct transverse bands; dark olive above, fading upon the sides; silvery below. Operculum, throat, and space in advance of the eye orange color." Mobile, Ala.

Z. guttatus Agass.

<sup>&</sup>quot;A large dark spot upon the centre of each scale on the back and sides, forming longitudinal rows of disconnected dots. The transverse bars of the male are much narrower and nearer together than in Z. lincolatus (nottii). Dark olive above, fading upon the side. Abdomen silvery." Mobile, Ala.

Z. hieroglyphicus Agass.

<sup>&</sup>quot;Anterior and upper parts of the body sprinkled with dark dots, passing into longitudinal rows backwards. Light olive above; silvery on the sides and below." Mobile, Ala.

### 555. Z. sciadicus (Cope) Jor.

Body short and stout. Eye equal to snout,  $3\frac{1}{2}$  in head,  $1\frac{2}{3}$  in interorbital space. Fins small. Coloration uniform olivaceous, without spots or lines. Head  $3\frac{1}{2}$ . D. 10; A. 12; scales 39–13. L. 2 inches. Platte River. (*Cope.*)

(Fundulus sciadicus Cope, Proc. Acad. Nat. Sci. Phil. 1865, 78: Haplochilus sciadicus Günther, vi, 316.)

### 556. Z. chrysotus (Günther) Jor.

Head depressed anteriorly. Snout shorter than the eye, which is  $3\frac{1}{3}$  in head and  $1\frac{1}{2}$  in interorbital space. Fins moderate. Light olive-colored, with narrow, dark, vertical streaks on the sides; caudal with bands of brown dots. Head  $3\frac{1}{2}$ ; depth 4. D. 9; A. 11; scales 34-12. Charleston, S. C. (Günther.)

(Haplochilus chrysotus Günther, vi, 317.)

#### 557. Z. zonatus (Mitch.) Jor.

Eye large,  $2\frac{1}{2}$  in head. Dorsal almost reaching the caudal, which is lanceolate. Sides with 12 black cross-bars; dorsal and anal dotted with black; other fins immaculate. D. 7; A. 10. Head  $4\frac{1}{2}$  in total length. South Carolina. (Günther.)

(? Esox zonatus Mitch. Trans. Lit. & Phil. Soc. i, 443: Fundulus zonatus C. & V. xviii, 196: Haplochilus zonatus Günther, vi, 316.)

#### 558. Z. cingulatus (C. &. V.) Jor.

Anal rather larger than dorsal; sides with ten or twelve broad, well-defined, vertical dark bars, nearly as broad as their interspaces; dorsal with a large black spot posteriorly, immediately in front of which is a white one; other fins immaculate. D. S; A. 9. Head 3\frac{3}{4}. Coast of New Jersey. (Günther.)

(Fundulus eingulatus C. & V. xviii, 197 (D. 8; A. 10): Hydrargyra luciæ Baird, Ninth Smithsonian Rept. 1855, 344: Haplochilus luciæ Günther, vi, 316.)

#### 160.-LUCANIA Girard.\*

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 118; type Lucania renusta Grd.)

Mouth moderate, the snout not produced; both jaws with a single series of conical teeth. Scales rather large. Dorsal and anal rays in moderate number, the dorsal in advance of the anal; anal fin not modified in the males. Very small fishes. (A coined name without meaning.)

#### \* GIRARDINICHTHYS Bleeker.

(Limnurgus Günther.)

(Bleeker, Cyprin. 1860, 481: type Girardinichthys innominatus.)

Body stout. Mouth small, the upper jaw very protractile. Teeth small, subcylindrical, in a single series in each jaw. Scales rather small. Dorsal and anal fins long,

#### 559. L. venusta Grd.

Body oblong, much as in *Zygonectes*. Dorsal midway of body, moderately elevated, much in front of anal. Snout rather pointed. Brownish, slightly spotted. Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ . D. 13; A. 11; Lat. l. 27. L.  $1\frac{1}{2}$  inches. Indianola, Tex. (Girard.)

(Limia renusta Girard, U. S. Mex. Bound. Surv. Ichth. 71, 1859; Girard, Proc. Acad. Nat. Sci. Phila. 1859, 118; Günther, vi, 310: Lucania affinis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 118.)

#### 560. L. parva (B. & G.) Beau \*

Form elongated. Head less than one-fourth the length (with the eaudal). Eye 3 in head. Coloration plain. D. 10; A. 10; V. 6; L. transv. 8. Very small. Long Island. (Günther.)

(Cyprinodon parrus B. & G. Ninth Smithsonian Report, 1855, 345: Cyprinodon parrus Günther, vi, 307.)

#### 561. L. goodei Jordan.

Body elliptical, rather elongate, the back considerably elevated to a point just in front of the origin of the dorsal fin; the caudal peduncle rather deep and compressed. Head short, comparatively narrow, and bluntly pointed. Mouth small, terminal; both jaws with rather large conical canine-like teeth, apparently in a single series. Eye large, near the middle of the side of the head, its diameter contained  $2\frac{1}{2}$  to  $2\frac{3}{4}$  times in the length of the head, about equal to the width of the interorbital space. Scales large, their exposed surfaces higher than long, in about 30 (29 to 32) longitudinal and 7 vertical series; humeral scale like the others. Fins large, especially in the males; origin of dorsal about midway between snout and base of caudal, conspicuously in advance of anal; height of dorsal fin in the males two-thirds the length of the head, about equal to the length of the base of the fin; anal fin similar and nearly as high and long, beginning nearly under the middle of the dorsal; caudal moderate, subtruncate; ventrals long, in the males

each with 20 or more rays, nearly opposite each other; anal fin not modified in the male. Intestinal canal short. Mexico. (Girardinus;  $i\chi\theta\nu$ s, fish.)

#### G. innominatus Bleeker.

Head thick, the snout obtuse, the mandible being directed vertically upward; neck arched so that the upper profile of the head is concave. Eye 5 in head,  $\frac{1}{2}$  the width of interorbital space. Olivaceous, with brown cross-bands, which are sometimes confluent. Head 4; depth  $3\frac{1}{4}$ . D. 20; A. 22; Lat. l. 44. Vicinity of city of Mexico. (Günther.)

(Lucania sp. Girard, Proc. Acad. Nat. Sci. Phila. 1859, 114; Bleeker, Cyprin. 484: Limuurgus variegatus Günther, vi, 309.)

\* Dr. Bean informs us that this species, the types of which he has examined, is a Lucania.

reaching the front of the anal, in the females reaching the vent; pectorals reaching past front of ventrals in both sexes. Color olivaeeous, the scales with dark edgings; a very distinct black band in both sexes running through eye and snout straight to the base of the caudal, where it ends in a round black spot; this band is about as wide as a series of scales, although developed on parts of two series; a conspicuous black band in both sexes along the lower edge of the caudal peduncle, from the root of the caudal to the vent, dividing and passing on each side of the anal fin; fins in the female plain; in the male, basal half of dorsal and anal jet black, outer half pale with a black edge; pectorals and especially ventrals also dark-edged; caudal fin faintly mottled; vertical fins with more or less red in life. Head 4; depth 4½. D. 9;  $\Lambda$ . 9. L. 1½ inches. Arlington River, Florida, a tributary of the Saint John's.

(Jordan, Proc. U. S. Nat. Mus. 1879, 240.)

#### 161.-GAMBUSIA Poey.\*

(Heterandria Agassiz.)

(Poey, Mem. Cuba, i, 382, 1851: type Gambusia punctata Poey, from Cuba.)

Body moderately elongate. Mouth medium; both jaws with a band of conical teeth; snout not produced; the lower jaw prominent. Eves

#### \* PSEUDOXIPHOPHORUS Bleeker.

#### (Paciliodes Steindachner.)

(Bleeker, Ichthyol. Ind. Prodr. Cypr. 1860, 483; type Xiphophorus bimaculatus Heckel.)

This genus has the general characters of Gambusia, differing in the larger size of the dorsal fin, which has 14-16 rays instead of 6-10. Mexico. (ψευδος, false; Xiphophorus.)

\* Anal process ending in a small hook.

#### P. bimaculatus (Heckel) Günther.

Each scale with a brown crescent; a black spot behind upper end of gill-opening, and a round blackish spot on upper half of root of caudal. Head  $4\frac{1}{2}$ ; depth  $4\frac{1}{4}$ . B. 6; D. 14; A. 10; scales 29-8. · L. 4 inches. Mexico. (Güuther.)

(Xiphophorus bimaculatus Heckel, Sitzgsber. Akad. Wiss. Wien, 1848, 169; Günther, vi, 332.)

\*\* Anal process without hook.

#### P. reticulatus Troschel.

Coloration as in the preceding; candal fin entirely blackish. Depth 6 in total length. D. 16; A. 8. Mexico. (G"unther.)

(Troschel, Müller's Reise Mexico, iii, App. 104; Giinther, vi, 333.)

#### BELONESOX Kner.

(Kner, Sitzgsber, Akad. Wiss. Wien, 1860, xl, 419: type  $Beloncsox\ belizanus\ {
m Kner.}$ )

Cleft of the mouth much developed laterally, the jaw bones being much produced. The intermaxillaries form together an elougate triangular plate, but are not anchy-

normal. Scales large. Dorsal and anal fins both rather short, the anal more or less in advance of the dorsal; anal fin of the male modified into a long intromittent organ, and much advanced. Intestinal canal short. Branchiostegals 6. Small fishes inhabiting the fresh waters of Mexico, Cuba, and the Southern States. The numerous species are imperfectly known.

("The name owes its etymology to the provincial Cuban word Gambusino, which signifies nothing, with the idea of a joke or farce. Thus one says 'to fish for Gambusinos' when one catches nothing."—Povy.)

#### 562. G. patruelis (B. & G.) Girard.

Snout broad, subspatulate, the lower jaw projecting. Eye longer than snout, 3 in head, 1½ in interorbital space. Anal process in ¿ longer than head, not curved at its extremity. Caudal pedancle rather elongate. A faint dark line across upper part of trunk; sometimes series of dark dots on sides of body; an oblique dark band below orbit; caudal with dark spots; coloration sometimes uniform. Head 3½; depth 4. D. 8; A. 9; scales 32–8. South Carolina to Mexico; abundant in lowland streams.

(Heterandria holbrooki Agassiz MSS.: Gambusia holbrooki Girard, Proc. Acad. Nat. Sci. Phila. 1859, 61: Gambusia holbrooki Giinther, vi, 334: Heterandria patruclis B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390; Girard, U. S. Mex. Bound. Surv. Ichth. 72.)

#### 563. G. humilis Günther.

Slender; anal larger than dorsal, and much anterior to it. Olive; dorsal and caudal with narrow blackish cross-bars. Head  $4\frac{1}{4}$ . D. 6; A. 9. Matamoras. (Girard.)

(Gambusia gracilis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 121, preoccupied; Günther, vi, 335.)

#### 561. G. arlingtonia Goode & Bean.

Uniform brownish olive; fins with a few blackish dots. Snout broad. Lower jaw projecting. Eye longer than snout, 3 in head. Dorsal inserted midway between posterior margin of eye and tip of tail. Pectorals reaching ventrals; ventrals to vent. Head 3\frac{1}{3}; depth 4. D. 9; A. 11; V. 6; Lat. I. 33; L. transv. 11. Arlington River, Florida; known from females only, and very likely a Zygonectes.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 118.)

losed together. Mandible long, somewhat prominent; both jaws with a broad band of cardiform teeth. Scales rather small. Anal in advance of dorsal, modified in the male into an intromittent organ. Branchiostegals 6. Intestinal canal short. Carnivorous. Mexico. (Belone; Esox.)

#### B. belizanus Kner.

Slender. Olivaceous; sides with series of brown dots; a black spot at root of candal. Head 3; depth  $5\frac{1}{2}$ . D. 9; A. 10; scales 60-18. Mexico and Central America. (*Kner.*) (Kner, l. e.; Günther, vi, 333.)

### 565. G. affinis (B. & G.) Grd.

Body moderately stout. Dorsal and anal fins similar in size and shape, the latter not much advanced. Coloration plain; dorsal and caudal dotted with black. Head 4; depth  $3\frac{4}{5}$ . D. 6; A. 8. Texas. (Girard.)

(Heterandria affinis B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390; Girord, U. S. Mex. Bound. Surv. Ichth. 72; Günther, vi, 336.)

#### 566. G. nobilis B. & G.\*

Body very deep, elevated in front of dorsal. Anal much smaller than dorsal. Ventrals very small. Coloration plain. Head 3½; depth 3½. D. 8; A. 7. L. 2½ inches. Texas. (Girard.)

(Heterandria nobilis B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390; Girard, U. S. Mex. Bound. Surv. Ichth. 71; Günther, vi, 335.)

(Two other species from the Rio Grande region, G. speciosa and G. senilis, are briefly and probably unrecognizably described by Girard, Proc. Acad. Nat. Sci. Phila. 1859, 121).

#### 162.-MOLLIENESIA Le Sucur.t

(Limia Poev.)

(Le Sueur, Journ. Acad. Nat. Sci. Phila. ii, 1821, 3: type Mollienesia latipinna Le Sueur.)

Body rather stout. Mouth small; mandible very short, its bones not united, the dentary being movable; both jaws with a narrow band of small teeth, besides an outer series of long, slender, movable teeth, which are curved and slightly compressed, placed on the outer edge of the jaw. Branchiostegals usually 5. Scales rather large. Anal fin

Anal process twice as long as head; the extremity bent. A dark band from upper end of gill-opening to the candal. Head 4; depth 4. D. 8; A. 9; scales 29-7. Orizaba, Mexico. (Günther.)

(Xiphophorus gracilis Heckel, Sitzgsber. Akad. Wiss. Wien, 1848, i, pt. 3, 300; Günther, vi, 336.)

†XIPHOPHORUS Heckel.

(Heckel, Sitzgsber. Akad. Wiss. Wien, 1848, i, pt. 3, 163: type Xiphophorus helleri Heckel.)

This genus differs from *Mollienesia* chiefly in the structure of its caudal fin, the lower rays of which in the males are prolonged into a long sword-shaped appendage, which in the adult is sometimes as long as the rest of the fish. Anal of the male modified into an intromittent organ, one or two of the enlarged rays being provided with hook-like processes. Branchiostegals 5. ( $\xi\iota\varphi o5$ , sword;  $\varphi o\rho\varepsilon\omega$ , to bear.)

#### X. helleri Heckel.

Sides with blue and yellowish-green bands or dark spots. Prolonged caudal appendage of the male nearly as long as the body, yellow, with black edges. Anal process with numerous hooks. Head  $4\frac{1}{6}$ ; depth  $3\frac{3}{4}$ . B. 5; D. 13; A. 9; scales 29-8. Mexico. (Günther.)

(Heckel I. e.; Günther, vi, 349.)

<sup>\*</sup> G. gracilis (Heckel) Gthr.

behind the dorsal, the anal of the male being modified into an intromittent organ; caudal fin alike in the two sexes; dorsal fin highly elevated in the male, its base elongate, of twelve or more rays. Intestines elongate, with numerous convolutions. Small mud-eating fishes, of variegated colors, found in Cuba, Mexico, and our Southern States. (Dedicated to Monsieur *Mollien*, French minister of finance, a patron of Péron, the friend and scientific associate of Le Sueur.)

### 567. M. latipinna Le Sueur.\*

Body short and deep, compressed. Eye equal to snout,  $3\frac{1}{2}$  in head, 2 in interorbital space. Inner teeth almost obsolete; outer series large, freely movable. Dorsal fin in the males greatly elevated, in the females moderate. Greenish, silvery below; a row of dark spots along each series of scales, and the lower part of the trunk also with a series of round brown spots; each scale with a silvery hinder margin; dorsal fin in  $\delta$  with 4 or 5 brown lines interrupted by the rays, and with a row of vertically ovate spots on its upper half; caudal membrane with black dots, the lower half of its hinder margin black. Female less spotted. Head  $3\frac{3}{4}$ ; depth  $3\frac{1}{5}$ . B. 5; D. 13; A. 7; scales 27–8. L.  $2\frac{1}{2}$  inches. Florida to Mexico; abundant in streams of the lowlands.

(Le Sueur, Journ. Acad. Nat. Sci. Phila. 1821, ii, 3; Günther, vi, 348: Pacilia multi-lineata Le Sueur, I. e. 4: Pacilia linealata Grd. U. S. Mex. Bound. Surv. Ichth. 70: Limia pacilioides Grd. U. S. Mex. Bound. Surv. Ichth. 70: Limia matamorensis Grd. Proc. Acad. Nat. Sci. Phila. 1859, 116.)

### 163.-PECILIA Bloch & Schneider.

### (Limia Poey.)

(Bloch & Schneider, Systema Ichthyologiæ, 1801, 452: type Pæilia vivipara Bloch & Schneider, from Surinam.)

This genus differs from *Mollienesia* only in the smaller size of the dorsal, which has usually nine or ten rays and is nearly opposite the anal in the female, but behind it in the male. The numerous species

Brownish, each seale with a black margin; a black band between eye and scapula; a round black spot on upper half of root of caudal; anal with a black line along each ray; other fins plain. Eye shorter than snout, 4 in head, 2 in interorbital width. Dorsal (in female) much longer than high; anal small, opposite middle of dorsal. D. 12; A. 10; Lat. l. 29; L. transv. 9. Volcanic lake, Huamantla, Mexico. (Günther.) (Günther, Ann. Mag. Nat. Hist. xiv, 370, 1874.)

<sup>\*</sup> M. formosa (Grd.) Gthr.

Body rather stout. Snout short. Fins different in the two sexes. Olivaceous, scales with brown spots; dorsal fin with transverse series of blackish spots; other fins immaculate. Head 3\frac{1}{4}; depth 3\frac{1}{4}. D. 12; A. 10. Palo Alto, Mexico. (Girard.) (Limia formosa Grd. Proc. Acad. Nat. Sci. Phila. 1859, 115; Günther, vi, 349.)

M. jonesi Gthr.

inhabit the West Indies, Mexico, and South America. (ποικιλος, variegated.)

\* Branchiostegals 5. (Pacilia.)

### 568. P. couchiana (Girard) Jor. & Gilb.

Body short, back convex; head small; scales very large. Brownish, each scale with a large brown spot; an obscure black lateral band; fins plain, except the dorsal, which has a few black spots. Head 4. D. 9; A. 6. Nuevo Leon, Mexico. (Girard.)

(Limia couchiana Grd. Proc. Acad. Nat. Sci. Phila. 1859, 116: Pacilia couchii Günther, vi, 347.)

#### 164.—GIRARDINUS Poey.\*

(Poey, Mem. Cuba, i, 383, 1851: type Girardinus metallicus Poey, from Cuba.)

Body moderately slender; mouth small; mandible very short, its bones not united; snout short; both jaws with a single series of slender, movable, pointed teeth; scales rather large; anal fin more or less in advance of dorsal, in the male modified into an intromittent organ; intestinal canal elongate; mud eating. Very small fishes, the smallest

#### \* PLATYPŒCILUS Giinther.

(Günther, Cat. Fishes Brit. Mus. vi, 350, 1866: type Platypæcilus maculatus Günther.)

Small fishes allied to Girardinus, but with the origin of the anal fin behind that of the dorsal. Mexico. (πλατυς, broad; ποικιλος, Pæcilus=Pæcilia.)

#### P. maculatus Gthr.

Body much compressed and elevated. Caudal pedunele short and deep. Olivaceous, a roundish black spot on middle of root of caudal; a black spot on middle of side of body; dorsal often spotted with black; margins of anal and caudal black. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{3}$ . D. 10; A. 9; scales 25-8. L.  $1\frac{1}{2}$  inches. Mexico. (Günther.)

(Günther, vi, 350.)

GOODEA Jordan.

(Jordan, Proc. U. S. Nat. Mus. 1879, 299: type Goodea atripinnis Jor.)

Form of Fundulus, but with the intestinal canal elongate, the dentary bones loosely joined, and the teeth slender, movable, tricuspid, attached in a single series on the outer edge of the jaws, not closely set. Fins small, the dorsal and anal similar, the dorsal slightly in advance of anal. No spines. Scales moderate. Limnophagous. Sexual changes, if any, unknown. Mexico. (Dedicated to G. Brown Goode.)

#### G. atripinnis Jordan.

Bluish above; sides nearly plain; a silvery streak along each row of scales. Vertical fins chiefly black, especially on the distal half. Body oblong, compressed, the back nearly straight, the candal peduncle deep. Head short, broad, depressed. Month small. Lower jaw projecting. Teeth loosely inserted, not close together. Eye  $3\frac{1}{2}$  in head, a little more than half the width of the interorbital space. Humeral scale somewhat enlarged. Fins small. Dorsal slightly in advance of anal. Caudal small. Head 4; depth 4. D. 12; A. 13; Lat. l. 38; L. transv. 13. L. 4 inches. Guanajnato, Mexico. From a salt lake in a volcanic basin.

(Jordan, Proc. U. S. Nat. Mus. 1879, 299.)

vertebrate animals known, found in the fresh waters of the warmer parts of America. (Dedicated to Charles Girard.)

### 569. G. formosus Grd.

Body short. Snout very short. Anal smaller than dorsal. Brownish olive, with a black streak from the snout along the middle of the side, crossed by 6 or 8 brownish-black vertical streaks; a black spot at bases of caudal, dorsal, and anal. Head  $3\frac{1}{2}$ ; depth  $3\frac{3}{4}$ . D.7; A.9; Lat.l. 28. L. 1 inch. South Carolina to Florida; said to be the smallest known fish.

(Girard, Proc. Acad. Nat. Sci. Phila, 1859, 62; Günther, vi, 354.)

### 570. G. occidentalis (B. & G.) Grd.

Brownish above, with a black lateral stripe; a black line along lower margin of tail. Fins unicolor. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ . D. 7;  $\Lambda$ . 7. Gila Basin. (Girard.)

(Heterandria occidentalis B. & G. Proc. Acad. Nat. Sci. Phil. 1853, 390; Girard, U. S. Mex. Bound. Ichth. 73; Günther, vi, 354: Girardinus sonoriensis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 120: Girardinus sonoriensis Günther, vi, 355.)

# FAMILY L.—UMBRIDÆ.

# (The Mud Minnows.)

Body oblong; broad anteriorly; compressed behind. Head large, flattened above. Mouth moderate, the maxillary without distinct supplemental bone. Bands of villiform or eardiform teeth on premaxillaries, lower jaw, vomer, and palatines; premaxillaries not protractile. Lateral margin of upper jaw formed by the broad, short maxillaries, which are toothless; lower jaw the longer. Gill-openings wide; the membranes scarcely connected; gill-rakers little developed; branchiostegals 6-8. Scales moderate, cycloid, covering head and body; lateral line obscure or wanting. Dorsal fin moderate, posterior, in advance of anal; ventrals small, close to anal; pectorals inserted low; caudal fin rounded. Stomach without blind sac; no pyloric cœca; pseudobranchiæ hidden, glandular; air-bladder simple; oviparous; sexes similar. Carnivorous fishes living in mud or among weeds at the bottom of clear sluggish streams and ponds, extremely tenacious of life, like the Cyprinodontidæ. Genera 2; species 3, Umbra crameri of Austria, and the following. The family is very close to the Esocidae, differing mainly in the smaller mouth and weaker teeth.

(Umbridæ Günther, vi, 231, 232.)

\* Pectorals narrow, with few (12-15) rays; ventral rays 6; scales moderate. UMBRA, 165.

\*\* Pectorals broad, with many (33-36) rays; ventral rays 3; scales small.. Dallia. 166.

### 165.—UMBRA Müller.

### Mud-fishes.

(Melanura Agassiz.)

(Kramer; Müller, Abhandl. Akad. Wiss. Wien, Berl. 1842, 188: type Umbra crameri Müller.)

Body oblong, covered with cycloid scales of moderate size, without radiating striæ; no lateral line. Head shortish, little depressed. Eye rather small. Cleft of mouth moderate. Ventral fins 6-rayed, below or slightly in front of dorsal; anal fin much shorter than dorsal. Pectorals rather narrow, rounded, placed low, with 12–15 rays, which are much jointed. Caudal rounded. Preopercle and preorbital with mucous pores. Branchiostegals 6. Gill-rakers short, thick. Size small. Two species, very similar to each other, inhabiting the waters of the United States and Austria. (Latin, *umbra*, a shade.)

### 571. U. liami (Kirt.) Gthr.-Mud Minnow; Dog-fish.

Dark-green or olive, mottled, sides with irregular narrow pale bars, these often obscure or wanting; a distinct black bar at base of caudal; whitish stripes sometimes present along the rows of scales. Head  $3\frac{3}{4}$  in length; depth  $4\frac{1}{4}$ . B. 6; P. 14; D. 14; A. 8; V. 6; Lat. I. 35; L. transv. 15. L. 4 inches. Vermont to Minnesota and South Carolina. Abundant northward in weedy streams and ditches. "A locality which with the water perfectly clear will appear destitute of fish will perhaps yield a number of mud-fish on stirring up the mud at the bottom and drawing a seine through it. Ditches in the prairies of Wisconsin, or mere bog-holes, apparently affording lodgment to nothing beyond tadpoles, may thus be found filled with Melanuras." (Baird.)

(Hydrargyra limi Kirtland, Bost. Journ. Nat. Hist. iii, 277: Melanura annulata Ag. Am. Journ. Sei. & Arts, 1854, 135: Umbra limi Günther, vi, 232: Leuciscus pygmæus De Kay, New York Fauna, Fishes, 214: Umbra pygmæu Jordan, Bull. U. S. Nat. Mus. x, 53; the eastern form, pygmæa, usually slightly differing in proportions.)

#### 166.-DALLIA Bean.

(Bean, Proc. U. S. Nat. Mus. 1879, 358: type Dallia pectoralis Bean.)

Body oblong, covered with small, partly embedded cycloid scales; a trace of lateral line; a line of mucous tubes below eye. Eye small. Cleft of mouth moderate. Villiform or almost cardiform teeth on jaws, vomer, and palatines; those on premaxillaries enlarged. Ventrals in

front of dorsal, composed of 3 rays; base of anal about as long as that of dorsal; caudal fin rounded; pectoral fin rounded, with a somewhat fleshy base, with 33-36 rays. Branchiostegals 7 or 8. Streams of Alaska. (Dedicated to W. H. Dall.)

### 572. D. pectoralis Bean.

Body dusky brown, mottled with whitish. Belly whitish, often speckled; fins with dark spots. Body rather elongate. Eye small, 6 or 7 in head. Pectoral about half as long as head; ventral one-third; anal beginning opposite front of dorsal and ending nearly opposite its last ray. Scales on belly very small. Head 4; depth 5. D. 12; A 13; P. 34; V. 3; scales 11-77-11. L. 8 inches. Saint Michael's, Alaska.

(Bean, Proc. U. S. Nat. Mus. 1879, 358.)

### FAMILY LI.—ESOCIDÆ.

(The Pikes.)

Body elongate, not elevated, more or less compressed. Head long; the snout much prolonged and depressed. Mouth very large; its cleft forming about half the length of the head; lower jaw the longer; upper jaw not protractile, most of its margin formed by the maxillaries, which are quite long and provided with a supplemental bone; premaxillaries, vomer, and palatines with broad bands of strong cardiform teeth which are more or less movable; lower jaw with strong teeth of different sizes; tongue with a band of small teeth. Head naked above; cheeks and opereles more or less scaly; gill-openings very wide; gill-membranes separate, free from the isthmus; gill-rakers tubercle-like, toothed; branchiostegals 12-20. Scales small; lateral line weak, obsolete in young specimens, developed in the adult. Dorsal posterior, opposite and similar to anal; caudal fin emarginate; pectoral fins small, inserted low; ventrals rather posterior; vent normal; no adipose fin; no barbels; stomach not eccal, without pyloric appendages; pseudobranchiae glandular, hidden; air-bladder simple. Fishes of moderate or large size, inhabiting the fresh waters of the northern parts of Europe, Asia, and North America. Genus 1; species about 6, one of them cosmopolitan, the rest all confined to America. The species are all noted for their greediness and voracity.

(Esocidæ Günther, vii, 226-230.)

#### 167.-ESOX Linnæus.

Piles

(Linnaus, Systema Natura: type Esox lucius L.)

Characters of the genus included above. (Latin, esox, a pike; Greek, ίσοξ; probably from ίσος, equal; όξος, sharp.)

- a. Checks as well as opercles entirely scaly; branchiostegals 11-14; color greenish, reticulated. (Picorellus\* Raf.)
  - b. Branchiostegals normally 12.

### 573. E. americanus Gmelin.—Banded Pickerel.

Body short and robust; head heavy, with blunt short snout,; eye rather large, about 5 in head, its diameter nearly half the length of the snort, its posterior margin scarcely behind middle of head; upper branchiostegals scaly. Dark green; sides with about twenty distinct, blackish, curved bars, sometimes obscurely marked, but not distinctly reticulated; a black bar below eye, another from upper edge of opercle through eye to snout. Head  $3\frac{3}{5}$ ; depth  $5\frac{1}{5}$ . B. 12-13; D. 11; A. 11; Lat. l. 105. L. 12 inches. A small pickerel, abundant from Massachusetts to Florida, in streams east of the mountains.

(Esox lucius, β americanus Gmelin, Systema Naturæ, 1788, 1390: Esox niger Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 415: Esox fasciatus Dekay, New York Fanna, Fishes, 224: Esox ornatus Storer, Fish. Mass. 313: Esox niger Günther, vi, 229: Esox raveueli Holbr. Ich. S. C. 1860, 201.)

### 574. E. salmoneus Raf.—Little Pickerel.

Body moderately stout, somewhat compressed; head rather short, longer than in E. americanus, but shorter than in E. reticulatus, the eye being exactly in the middle of the head; eye large, less than 3 times in snout, about 6 in head; caudal well forked. Color green or grayish; sides with many curved streaks, sometimes forming bars, but more usually forming marmorations or reticulations, the color extremely variable, sometimes quite plain; sides of head usually variegated; a dark bar downward from eye, and one forward; base of caudal sometimes mottled; other fins usually plain. Head 34; depth 5-6. D. 11; A. 11; Lat. 1. 105. L. 12 inches. Mississippi Valley and southeastward, a small species very abundant in the small streams and bayous of the South and West.

(Rafinesque, Ich. Oh. 1820, 70; Jordan, Man. Vert. ed. 2d, 268: Esox umbrosus Kirtland, Cleveland Annals of Science, 1854, 79: Esox umbrosus Cope, Trans. Am. Phil. Soc. Phila. 1866, 409: Esox cypho Cope, Proc. Acad. Nat. Sci. Phila. 1865, 79: Esox cypho Günther, vi, 230: Esox porosus Cope, Trans. Am. Phil. Soc. Phila. 1866, 408. This form (cypho = porosus), distinguished mainly by the arched back and steep profile, is probably a variety or accidental form of the preceding.)

<sup>\*</sup> Rafinesque, Ich. Oh. 1820, 70: type Esox vittatus Raf. (A latinization of pickerel.)

bb. Branchiostegals 14-16.

#### 575. E. reticulatus Le Sueur.—Common Eastern Pickerel; Green Pike.

Body rather slender, deepest near the middle and tapering backward to a slender caudal peduncle; head long, the snout prolonged, so that it is not much shorter than the rest of the head; eye small, about 3½ in snout, 8 in head; caudal well forked. Color green of varying shades, sides with golden lustre, and marked with numerous dark lines and streaks, which are mostly horizontal, and by their junction with one another produce a reticulated appearance; a dark band below eye; fins plain. Head 3½; depth 6. B. 15; D. 14; A. 13 (counting developed rays only as in other cases); Lat. l. 125. L. 24 inches. Maine to Alabama, everywhere east of the mountains, not found west of the Alleghanies.

(Le Sueur, Journ, Acad. Nat. Sci. Phila. i, 440, 1818; Günther, vi. 229; Storer, Fish. Mass. 311, and of all authors: Esox affinis Holbrook, Ich. S. Car. 1860,198; Esox phaleratus Say, Journ. Acad. Nat. Sci. Phila. i, 416.)

aa. Cheeks sealy; lower half of opercles bare; branchiostegals 14-16; species lightspotted on a darker ground. (Esox.)

#### 576. E. lucius L.-Pike.

Body moderately elongate, the back little elevated; head rather long, the eye exactly midway in its length. General color bluish, or greenish gray, with many whitish spots which are usually smaller than the eye and arranged somewhat in rows; dorsal, anal, and caudal fins with roundish black spots; young with the white spots coalescing, forming oblique cross bars; a white horizontal band bounding the naked part of the operculum. Head  $3\frac{2}{3}$ ; depth 5; eye  $6\frac{1}{3}$  in head. B. 15, in the American var. estor (13 or 14 in European specimens); D. 17; A. 14; Lat. l. 123. L. 2–4 feet. Fresh waters of the northern parts of Europe, Asia, and North America; in the Eastern United States south to Northern Ohio; very abundant.

(Esox lucius L. Syst. Nat.; Günther, vi, 226, and of authors generally: Esox estor Le Sueur, Journ. Aca& Nat. Sci. Phila. i, 413, 1818: Esox estor Günther, vi, 228: Esox deprandus Günther, vi, 229: Esox boreus Agassiz, L. Superior, 317.)

aaa. Lower half of cheeks as well as of opercles bare; branchiostegals 17-19; black-spotted on a lighter ground. (Musculongus\* Jordan.)

### 577. E. nobilior Thompson,-Muskallunge.

General form of *E. lucius*, the head a little larger proportionally; scaly part of cheeks about as wide as eye; the scales on both cheeks

<sup>\*</sup> Jordan, Rept. Ohio Fish. Com., 1877, 92: type Esox uobilion Thompson. (Latin, masca, mask; longus, long.)

Bull. Nat. Mus. No. 16——23

and opercles in about 8 rows. Color dark gray; sides with round blackish spots on a ground color of grayish silvery; belly white; fins spotted with black. Head  $3\frac{3}{3}$ ; depth 6. B. 18; D. 17;  $\Lambda$ . 15; Lat. 1. 150. L. 4 to 8 feet. A magnificent fish, by far the largest of its family, found in the Great Lake region and northward.

(Esox estor Dekay, N. Y. Fauna, Fishes, 222, and of various authors, not of Le Sueur; Thompson, Proc. Bost. Soc. Nat. Hist. 1850, iii, 163; Jordan, Bull. U. S. Nat. Mus. x, 54, and of most late writers.)

# ORDER O.—APODES.\*

(The Eels.)

Scapular arch free behind the cranium; no præcoracoid arch. Airbladder, if present, with a pneumatic duct. Ventral fins wanting. Maxillary and premaxillary more or less connate with other bones or with each other, sometimes entirely wanting. Pharyngeal and opercular apparatus often deficient. Vertebræ in increased number. Vertical fins without spines, usually confluent around the tail. Gill-openings usually narrow, separated by a broad isthmus, sometimes close together or confluent. No pseudobranchiæ. Body eel-shaped; naked, or with rudimentary scales.

As here understood, this order includes most of the old order of Apodes, excluding as separate orders the Glanencheli (Gymnotidw) and the Iehthyocephali (Monopteridw). It thus includes the Holostomi, Enchelycephali, and Colocephali of Cope, which may be united provisionally until the osteology of various aberrant forms is made known. (a, privative;  $\pi obs$ , foot.)

(Symbranchida and Muranida Günther, viii, 12-145.)

### ANALYSIS OF FAMILIES OF APODES.

- \* Vent much behind head; jaws not greatly produced; dorsal without spines.

  † Muscular and osseous systems well developed.
  - a. Preopercle wanting; lower pharyngeals wanting; gill-openings very small.

    MURENIDE, 52.
    - aa. Preoperele present; lower pharyngeals present.

      - bb. Gill-openings contiguous; mouth very large, with small, sharp teeth.
        - SYNAPHOBRANCHIDÆ, 54.

<sup>\*</sup> Called Enchelycephali in the analytical table on page 81

### FAMILY LIL-MURÆNIDÆ.

(The Muranas.)

Body elongate, eel-shaped, naked. Head subconical, elevated at the occiput, the snout rather slender; skull less developed than in fishes generally, the opercular bones rudimentary, the preoperculum generally wanting. Premaxillary rudimentary or wanting. Ethmoid very wide. Maxillary, symplectic, pterygoid, basal-branchihyal, superior and inferior pharyngeal bones all wanting, except the fourth superior pharyngeal, which is jaw-like, and supported by a strong superior branchihyal. Teeth various. Gill-opening reduced to a small slit or foramen. Ventral fins none. Pectorals usually wanting; dorsal and anal low, confinent around the tail, sometimes wanting. Skeleton well ossified. Muscular system well developed. Genera 5 or 6; species about 110. Abundant in warm seas, often reaching a large size.

(Murwnidæ engyschistæ Günther, viii, 93-136: order Colocephali Cope, Trans. Amer. Phil. Soc. 1870, 456.)

a. Pectorals none; vertical fins well developed; nostrils round; teeth all acute.
 MURÆNA, 168.

#### 168.-MURZEVA Linneus.

(Artedi; Linn. Syst. Nat.: type Murana helena L.)

Pectoral fins none; dorsal and anal fins well developed. Posterior nostril round, with or without tube; anterior nostril with a tube. Teeth well developed, acute. Tongue not free. No lateral line. Body usually moderately elongate. Species very numerous in warm seas. (μόραινα, the ancient name of Muræna helenæ; from μόρον, a sweet oil.)

a. Posterior as well as anterior nostrils tubular. (Murana.)

#### 578. M. melanotis (Kaup) Gthr.-Moray.

Brownish black, everywhere with numerous round yellowish spots, most of which are smaller than the eye, these sometimes confined to the head and trunk; a large round black spot around the gill-opening; angle of mouth black. Nasal tubes subequal in length, shorter than the eye. Maxillary teeth biserial, and in young examples mandibulary teeth also. Canine teeth somewhat knife-shaped, of moderate length. Mouth capable of being completely shut. Gill-opening narrow, not wider than the small eye. Snout of moderate length. Cleft of mouth of moderate length, about  $2\frac{1}{2}$  in length of head. Tail longer than body. Head  $2\frac{1}{2}$  in length of trunk. West Indies, &c. (Günther.) Specimens

probably belonging to this species lately obtained at Charleston, S. C., by Mr. R. E. Earll.

(Limamurana melanotis Kaup, Aale Hamburg Mus. 27; Günther, viii, 98.)

aa. Posterior nostril without tube. (Gymnothorax\* Bloch & Schneider.)

### 579. M. mordax Ayres.—Conger Eel.

Dark brown, vaguely reticulated with narrow, paler markings and spots; a round dark blotch about gill-opening; lower side of head and throat with about 15 dark lengthwise streaks; belly with similar streaks running crosswise; a dark line on each side of base of anal. with short cross-branches. Snout short, narrow, and pointed. Occipital region becoming fleshy and much elevated with age. Tail forming about half the total length. Head 7 in length. Tube of anterior nostril half as long as the eye; posterior nostril with a slight border. Eye above the middle of the gape, 21 in snout, which is 61 in rest of head. Gill-opening slightly larger than eye. Sides of upper jaw with two series of teeth posteriorly, the outer series of small, close-set, recurved, triangular teeth, which are immovable; inner teeth about 5, similar, but larger, depressible; a groove between the two series; in front of these, continuous with the outer series, are 3 fixed, knifeshaped teeth, then a movable tooth, then 3 fixed teeth; on the middle line of vomer 3 depressible fangs, the posterior the largest of the teeth; in the lower jaw a single series, corresponding to the outer series in the upper jaw, some of the front teeth enlarged and fixed. Reaches a length of 5 feet. Point Concepcion to Cape San Lucas; abundant about the islands, and remarkable for its ferocity.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 30.)

### 580. M. occilata (Agassiz) Jenyns.

Teeth uniserial, some of them slightly serrated. Mandible with 12-14 teeth on each side, the two anterior being canines of moderate size; "intermaxillary" teeth not much larger than "maxillary"; there are no teeth on the mesial line between the "intermaxillary" teeth. The mouth can be shut completely. Anterior nasal tubes short. Snout short, thick. Eye rather small. Cleft of the mouth of moderate width, extending beyond eye. Tail longer than the body. Head about half as long as trunk. Brownish, with numerous, small round white spots irregularly disposed, the largest about as large as the eye. Dorsal fin

<sup>\*</sup> Bloch & Schneider, Syst. Ichth. 525, 528; originally equivalent to *Murana*. (γύμνος, naked; θοραξ, chest; in allusion to the absence of pectorals.)

with subalternate large white and black spots; anal (and dorsal) with a broad black margin. (Günther.) Florida and Texas southward.

(Gymnothorax occillatus Agassiz, Spix Pisc. Brasil, 91; Günther, viii, 102: Neomurana nigromarginata Girard, U. S. Mex. Bound. Surv. Ichth. 76.)

# FAMILY LIII.—ANGUILLIDÆ.

(The True Eels.)

Body clongate, serpentiform, naked or covered with imbedded scales. Head conical, the snort not much produced, sometimes very blunt. Preoperculum present. Premaxillaries present, separated on the median line by the ethmoid. Maxillaries wanting or connate with the premaxillary, which forms the border of the mouth. Superior branchihyals and inferior and superior pharyngeals well developed, the latter of three bones. Teeth various. Gill-openings separate, not very small (except in Simenchelys). Ventral fins none; dorsal and anal low, usually confluent around the tail; pectorals generally present, placed rather high. Vent not far from anal fin. Skeleton ossified. Muscular system well developed. Heart not far behind gills. As here understood, this family includes a wide variety of forms, which have been often arranged in several families. It is probable that some division will be found necessary, but we have not the data on which to make it. Genera about 20; species about 160. In all warm seas, many of them ascending rivers.

(Anguillida, part; Gthr. viii, 23-90.)

- a. Tongue not free anteriorly.
  - b. End of tail not surrounded by the fin; nostrils labial. (Ophisurine.)
    - c. Pectoral fins wanting (rarely rudimentary); teeth small, conical. Cœcula, 169.
  - cc. Pectoral fins present; teeth acute.....Ориснтихь, 170.
  - bb. End of tail surrounded by the fin.
    - d. Nostrils labial. (Myrinw.)
    - dd. Nostrils superior or lateral. (Muranesociua.)
- f. Pectoral fins present; dorsal and anal rudimentary....Neoconger, 172. aa. Tongue free anteriorly; pectorals present; nostrils not labial.
  - g. Snout subconical.
    - h. Body scaleless. (Congrina.)
    - Mt. Body with rudimentary, linear, imbedded scales, arranged at right angles with each other. (Anguilling.)
  - j. Teeth in bands; lower jaw projecting........ANGULLA, 174.
    gg. Snort very short and blunt; body scaly; mandible very strong.
    (Simenchelyinæ.)

#### 169.—CŒCULA Vahl.

(Sphagebranchus Bloch & Schneider.)

(Vahl, Skrivt. Naturh. Selsk. iii, 1794, 149: type Cœeula pterygera Vahl=? Dalophis polyophthalmus Bleeker.)

Body extremely slender. Teeth equal, small, conical, on jaws and vomer. Nostrils labial. Tongue not free at tip. Pectoral fins wanting or rudimentary; dorsal fin present. Extremity of tail free. Gill-openings small, separated by a narrow isthmus. Eyes small. (Latin, cacus, blind.)

### 581. C. scuticaris (Goode & Bean) J. & G.

Brownish, paler below. Teeth small, conical, in two series on jaws and vomer. Gill-openings close together. Dorsal fin beginning far in advance of the gill-opening, a little nearer the tip of the snout than the gill-opening, at a distance from the former equal to three times the length of the snout. Head  $8\frac{1}{2}$  in distance from gill-opening to vent, and 8 in tail. Snout pointed, 6 in head. Pectorals extremely small, their length less than  $\frac{1}{300}$  the total length. (Goode & Bean.)

(Sphagebranchus scuticaris Goode & Bean, Proc. U. S. Nat. Mus. 1879, 344.)

#### 170.-OPHICHTHYS Ahl.

(Ophisurus Lacépède.)

(Ahl, Specim. Ichth. 1789, 9.)

Body elongate, naked. Teeth all pointed; vomerine teeth present. Nostrils labial. Tongue not free at tip. Dorsal and anal fins present; pectoral fins developed. End of tail not surrounded by the fin. Species very numerous, found in all warm seas. ( $o\psi z_5$ , snake;  $z_7 \partial v_5$ , fish.)

\* Canine teeth very distinct. (Mystriophis\* Kaup.)
†Teeth in each jaw in a double series.

### 582. O. punctifer (Kaup) Günther.

Snout narrowed, short, spoon-shaped, twice as long as the eye. Cleft of the mouth very wide. Teeth pointed, fixed, unequal in size, those of the premaxillary in a single arched series, the foremost being the longest of all the teeth; outer series of teeth in jaws with canines; vomerine teeth triserial, rather small. Lips not fringed. Gill-openings wide. Origin of the dorsal fin at some distance behind the pectoral, which is well developed. Tail somewhat longer than the body.

<sup>\*</sup> Kaup, Apodes, 1856, 10: type Ophisurus rostellatus Rich. (μυστρον, spoon; οφις, snake; from the form of the snout.)

Brownish, with numerous small roundish black spots. (Günther.) West Indies, north to West Florida.

(Crotalopsis punctifer Kaup, Abhandl. Naturwiss. Verein Hamburg, iv, 2, 1860: Macrodonophis mordax Poey, Rept. Fis.-Nat. Cuba, ii, 252, 1868: Crotalopsis mordax Goode & Bean, Proc. U. S. Nat. Mus. 1879, 154; Günther, viii, 56.)

\*\* No distinct canine teeth; snont moderate. (Muranopsis\* Le Sueur.)

! Teeth in the lower jaw in a double series; eleft of mouth wide.

## 583. O. triserialis (Kaup) Günther.

Body with larger and smaller roundish black spots, alternating; head with many small black spots above and below; belly plain; head and body with longitudinal streaks. Gill-openings curved, well separated, a little longer than pectorals. Head with longitudinal wrinkles, its length two-fifths the distance from the gill-opening to the vent. Mouth wide, its cleft more than one-third the head. Eye moderate, 13 in snout. Teeth pointed, fixed, all biserial, except those on vomer, which are uniserial. Pectoral fin 3½ in head, the dorsal beginning above its terminal portion. Tail rather longer than body. Southern California to Brazil. (Described from Garrett's type of O. californiensis.)

(Muranopsis triscrialis Kaup, Apodes, 1856, 12; Günther, viii, 58: Ophisurus californieusis Garrett, Proc. Cal. Acad. Nat. Sci. iii, 63.)

‡‡ Teeth in lower jaw in one series. (Herpetoichthys Kanp.)

# 581. O. occilatus (Le S.) Günther.

A series of round white spots along the middle of the side of the body and tail; dorsal fin with a black edge; some white dots on the back behind the head and a white line across the occiput. Length of the head rather less than one-third of the distance of the gill-opening from the vent. Snout pointed, the upper jaw projecting beyond the lower. Cleft of the month wide, two-fifths the length of the head. Eye of moderate size, two-thirds of the length of the snout, and situated in the anterior third of the head. Teeth pointed, fixed, unequal in size; the intermaxillary teeth largest, arranged in a curved, transverse series; maxillary teeth in a double, vomerine and mandibulary teeth in a single series; only the anterior mandibulary teeth form a short, double series. Length of the pectoral fin rather more than one-third that of the head; dorsal fin commencing opposite the posterior third of the pectoral. Tail longer than the body. (Günther.) West Indies, north to West Florida.

(Muranopsis occilatus Le Sueur, Journ. Acad. Nat. Sci. Phila. v, 108; Giinther, viii, 68: Herpetoichthys occilatus Goode & Beau, Proc. U. S. Nat. Mus. 1879, 155.)

<sup>\*</sup> Le Sueur, Journ. Acad. Nat. Sci. Phila. v, 108: type Muranopsis occilata Le S. (μύραινα, Murana; οψις, appearance.)

## 171.-NIVERCHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 58: type Myrichthys tigrinus Grd.)

Pectorals present; dorsal inserted in advance of base of pectorals, at a point nearer to them than to the eye. Head large; the lower jaw shorter than the upper. Teeth granular, disposed in elongated patches on the jaws, palatines, and nasal bones. Eyes well developed. Gill-openings lateral, moderate. Body naked. Nostrils near the end of the snout, the upper very small, opposite the lower, which are conspicuous and tubular. ( $\mu\nu\rho\sigma\varepsilon$ , Myrus, an ancient name of Murana;  $i\chi\theta\varepsilon$ , fish.)

# 585. M. tigrimus Grd.

Brownish above, throat and belly dull whitish; roundish, dark brown spots on the body in four longitudinal series; belly plain; throat with whitish spots; spots on head smaller and deeper in color. Fins olivaceous; pectoral and anal plain; dorsal spotted like the body, white-edged. Body subcylindrical, somewhat compressed, tapering backward. Pectorals broader than long. Head 12 in length. Cleft of mouth extending beyond eyes. Teeth unequal, in many series; three series on the front of the dentary bones; two on the upper jaw and two on the shaft of the vomer. Length 2 feet. (Girard.) Adair Bay, Oregon, not found by recent collectors.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 58.)

### 172.-NEOCONGER Girard.

(Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 77: type Neoconger mucronatus Grd.)

Sealeless. Pectoral fins present; dorsal and anal fins rudimentary, passing around the tail, towards the end of which they are more developed. Cleft of the mouth extending beyond the small eye; maxillary teeth slender, in several series; vomerine teeth uniserial, forming a patch in front; posterior nostrils near the anterior rim of the orbit, anterior near the tip of the snout; tail not much longer than the body. Gillopenings vertical, rather large. Gulf of Mexico. (νέος, new; χόγγρος, Conger.)

# 586. N. mucromatus Grd.

Dark reddish brown above, paler below; head small, slender, pointed; upper jaw the longer; dorsal fin beginning just in front of the vent, forming a membranous ridge until near the tail, where it expands and becomes fin-like; pectorals small. Coast of Texas. (Girard.)

(Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 77; Günther, viii, 49.)

## 173 .- ANGUILLA Thunberg.

### Eels

(Thunberg, Nouv. Mém. Stockh. about 1791: type Muræna anguida L.)

Body elongate, compressed behind, covered with imbedded scales, which are linear in form, and placed obliquely, some of them at right angles to others. Lateral line well developed. Head long conical, moderately pointed, the rather small eye well forward and over the angle of the mouth. Teeth small, subequal, in bands on each jaw and a long patch on the vomer. Tongue free at tip. Lips rather full, with a free margin behind, attached by a fremum in front. Lower jaw projecting. Gill-openings rather small, slit-like, about as wide as base of pectorals and partly below them. Nostrils superior, well separated, the anterior with a slight tube. Vent close in front of anal. Dorsal inserted at some distance from the head, confluent with the anal around the tail. Pectorals well developed. Species numerous, in most warm seas, ascending streams, but mostly spawning in the sea. (Latin, anguilla, an eel.)

# 587. A. rostrata\* (Le Sueur) Dekay.-Common Eel.

Brown, nearly plain, often tinged with yellowish; paler below. Distance from shout to dorsal about one-third the length. Distance between anal and front of dorsal about equal to the length of the head. Head 8½ in length, 2½ in distance from gills to vent. Pectoral shorter than mandible. L. 50 inches. Atlantic coast of the United States; very abundant from Maine to Mexico; ascending all streams and resident throughout the Mississippi Valley. Also recorded from China.

(Murana rostrata and bostonicusis Le Sueur, Journ. Acad. Nat. Sci. Phila. i, S1: Anguitta bostonicusis Günther, vii, 31. Var. ? texana Kaup, from the Gulf of Mexico is characterized by its thicker lips: Anguilla texana Kaup, Apodal Fish. 45: Anguilla tyraunus Grd. U. S. Mex. Bound. Surv. Ichth. 75.)

<sup>\*</sup> Another species has been accredited to our coast, viz:

A. rulgaris Raf.—European Ecl. Distance from snout to dorsal 33 in length. Distance from front of anal to front of dorsal, about a third longer than the head. Head 94 in length. Pectoral about as long as the mandible. Vertebræ 45 + 70. Coasts of Europe, perhaps straying to our coasts. "I have examined an example from New Jersey; it is in the Liverpool Museum (Günther)."

<sup>(</sup>Murana auguilla L. Syst. Nat.; Rafinesque, Indice d'Ittiol. Sicil. 1810, 37; Turton, Brit. Fauna, 87; Giinther, viii, 23: Auguilla acutirostris Risso, Eur. Mérid. iii, 198.)

### 174.—CONGER\* Cuvier.

# Conger Eels.

(Cuvier, Regno Anim. II, 1817: type Murana conger Linn, etc.)

Body formed as in Anguilla, the skin scaleless. Head depressed above, anteriorly pointed. Lateral line present. Mouth wide, its eleft extending at least to below the middle of the eye. Teeth in the outer series in each jaw equal and close-set, forming a cutting-edge. No canines. Band of vomerine teeth short. Tongue anteriorly free. Vertical fins well developed, confluent around the tail; pectoral fins well developed; dorsal beginning close behind pectorals. Gill-openings rather large, low. Eyes well developed. Posterior nostril near eye; anterior near the tip of the snout, with a short tube. Lower jaw not projecting. Skeleton different in numerous respects from that of Anguilla. Vertebræ about 56+100. In most warm seas.

The name Leptocephalus was first given to a peculiar band-shaped, pellucid, worm-like animal, the type of a considerable group of fishes, the Leptocephalidæ or Helmichthyidæ, which has been made to constitute a distinct order, Lemniscati. It has, however, been satisfactorily shown by Carus, Gill, Günther, and others, that these singular forms are not distinct species, but are early stages in the development of other fishes, Leptocephalus morrisii, of Conger niger, and the others of various Anguilloid, Stomiatoid, and Clupeoid forms. (See Günther, viii, 136.) It is thought by Dr. Günther that the Leptocephalid forms are probably "individuals arrested in the development at a very early period of their life, yet continuing to grow to a certain size, without corresponding development of their internal organs, and perishing without having attained the characters of the perfect animal." (zόγγρες, Conger, the ancient name of the Conger Eel.)

# 588. C. niger (Risso) J. & G.—Conger Eel.

Dark brown above, lower parts soiled white; dorsal and anal pale, with a black margin (sometimes uniform black); pectorals dusky, edged with paler; pores of lateral line whitish. Dorsal inserted over the posterior margin of the pectoral, or slightly behind it; pectoral one-third

<sup>\*</sup>The prior name Leptocephalus (Gmelin, Syst. Nat. i, 1150, 1788: type Leptocephalus morrisi Gmel., an arrested larval form of Conger) should, in strictness, supersede Conger. The use of the term for the adult normal fish would, however, lead to confusion, as Leptocephalus has for nearly a hundred years been applied to various singular organisms, lately shown to be undeveloped forms of eels and of certain Isospondyli.

as long as the head. Teeth in a single series on the sides of the jaw, in a broad patch at the tip. Cleft of mouth extending to beyond the middle of the rather large eye. Jaws equal or the lower included. Distance from snout to vent three times the length of the head. Head  $7\frac{1}{3}$ . L. 50 inches. Europe, to South America and East Indies, frequently taken on our Atlantic coast. We are unable to detect any difference between American and European examples. It sometimes reaches a length of 8 feet.

(Auguilla conger L. Syst. Nat.: Marana nigra Risso, Ichth. Nice, 1810, 93: Conger vulgaris Cuyier, Règne Anim. 1817: Auguilla occanica Mitchill, Journ. Acad. Nat. Sci. i, 407: Conger occidentalis Dekay, N. Y. Fanna, Fishes, 314, 1842: Conger vulgaris Günther, viii, 38: Conger occanicus Gill, Rept. Com. Fisheries for 1871-72, 811.)

## 175.—SIMENCHELYS Gill.

# Pug-nosed Eels.

(Gill MS.; Goode & Bean, Bull. Essex Inst. xi, 1879, 27: type Simenchelys parasiticus Gill.)

Body eel-shaped, covered with linear imbedded scales, disposed at right angles as in Anguilla. Lateral line present, faint. Head very short, rounded, very blunt anteriorly, slightly compressed. Mouth small, entirely anterior. Premaxillaries and maxillaries of each side side coalesced and separated from those of the other side by the ethmoid. Jaws equal, their edges hard, provided with a single series of small, rounded, close-set, incisor-like teeth. No vomerine teeth. Tongue broad, somewhat free anteriorly. Mandible very deep and strong. Operculum sabre-shaped. Gill-openings very small, inferior, longitudinal, well separated, situated in front of the pectorals and below them. Both nostrils large, the anterior with a slight rim, but no tube. Lips full. Pectorals short; vertical fins confluent around the tail, the dorsal beginning not far behind pectorals; vent in front of anal, near middle of body. One species known, probably the type of a distinct family. (σ:μος, pug-nosed; ἔγχελος, eel.)

# 589. S. parasiticus Gill.

Dark brown, nearly plain. Eye rather large, anterior, but behind the angle of the month, scarcely shorter than the snout. Head  $\frac{1}{5}$  length of trunk; about  $\frac{1}{2}$  distance from snout to origin of dorsal; width of gill slit equaling diameter of orbit; interorbital space nearly half length of head. Vent not much in advance of middle of body. Dorsal beginning just behind tips of pectorals; fins rather low. Off-shore banks, south of Newfeendland; abundant. Individuals have been found burrowing in the flesh of the halibut.

(Gill, MS. in Goode & Bean, Bull, Essex Inst. xi, 27, 1878.)

# FAMILY LIV.—SYNAPHOBRANCHIDÆ.

(The Synaphobranchoid Eels.)

Body eel-shaped, covered with linear, imbedded scales placed at right angles, as in Anguilla. Lateral line present. Head long and pointed, the snout produced. Mouth very long, the eye being over the middle of its cleft. Jaws about equal: teeth small, sharp, in a broad band in each iaw, becoming a single series anteriorly; those of inner series in upper jaw and of outer series in mandible somewhat enlarged; vomerine teeth in a narrow band anteriorly. Gill-openings inferior, horizontal, close together, convergent forward, somewhat confluent at the surface, but separated by a considerable isthmus within. Tongue long, free only at the sides. Nostrils large, the anterior with a short tube, the posterior before the lower part of the eye. Pectoral well developed; dorsal low, beginning behind vent; anal longer than dorsal, rather high, its rays slender, branched, not imbedded in the skin; vertical fins confluent around the tail. Vent near the anterior fourth of body. Muscular and osseous systems well developed. Stomach very distensible. Deep-sea fishes: a single genus with 4 species known.

(Muranida, group Synaphobranchina Günther, viii, 22-23.)

### 176.-SYNAPHOBRANCHUS Johnson.

(Johnson, Proc. Zoöl. Soc. London, 1862, 169: type Synaphobrauchus kaupii Johnson = Murwua pinnata Gronow.)

Characters of the genus included above. (συνᾶψής, joined; βραγχος, gills.)

# 590. S. Dimmatus (Gronow) Günther.

Uniform brown, rather darker below; the vertical fins darker behind, light-edged anteriorly; inside of month blue-black; gill-openings dark. Jaws subequal in length, sometimes the lower, sometimes the upper the longer; the upper with a projecting fleshy tip; maxillary reaching to opposite gill-openings, which are rather longer than the large eye. Head 3\frac{3}{3} in distance from snout to dorsal, 2\frac{3}{4} in distance to anal, 8\frac{3}{3} in length. Eye broader than interorbital space, rather nearer tip of snout than end of maxillary. Pectoral slender, longer than snout. Newfoundland to Madeira, "a common resident of the deep waters of the off-shore banks in 200 to 300 fathoms, where individuals are often taken on the fishermen's trawl lines."

(Murwua pinnata Gronow, Syst. Ich. ed. Gray, 1854, 19; Günther, viii, 22; Goode & Bean, Bull. Essex Inst. xi, 1879, 26.)

# FAMILY LV.—SACCOPHARYNGID.E.

(The Gulpers.)

Muscular system very feebly developed, with the bones very thin, soft, and wanting in inorganic matter, connected by a lax, easily torn fibrons Head and gape enormous. Snout very short, pointed, flexible, like an appendage overlapping the gape. Eye small. Maxillary and mandibulary bones very thin, slender, arched, armed with one or two series of long, slender, curved, widely-set teeth, their points being directed inwards; palate toothless. Gill-openings wide, at some distance from the head, at the lower part of the sides; gills very narrow, free, and exposed. Trunk of moderate length. Stomach distensible in an extraordinary degree. Vent at the end of the trunk. Tail bandlike, exceedingly long, tapering into a very fine filament. Pectoral present, small. Dorsal and anal fins rudimentary, the former smaller than the latter, and indicated by a groove bordered by a whitish line on each side, and commencing at a short distance behind the head; a short fine ray occasionally visible towards the end of the trunk. Anal rays distinct, commencing behind the vent, and visible for some distance. One species known, from the North Atlantic.

(Muranida, group Saccopharyngina Günther, viii, 22.)

### 177.-SACCOPHARVNX Mitchill.

(Mitchill, Ann. Lyc. Nat. Hist. N. Y. i, 1824, 82: type Saccopharynx flagellum Mitch.)

Characters of the genus included above. (Latin, saccus, sack; pharynx, pharynx.)

# 591. S. flagellum Mitch.

Uniform deep black. Three specimens have been found floating in the North Atlantic, with their stomachs much distended, they having swallowed some other fish, the weight of which many times exceeded their own. (Günther.)

(Mitchill, Ann. Lyc. Nat. Hist. N. Y. i, 1824, 82; Günther, viii, 22: Ophiognathus ampullaceus Harwood, Phil. Trans. 1827, 277.)

# FAMILY LVI (a).—NEMICHTHYIDÆ.

(The Snipe-Eels.)

Body excessively slender, not strongly compressed, deepest near the middle, tapering backward to the long and very slender filament-like tail, and forward to a very long and slender neck, which is abruptly

enlarged at the occipital region. No scales. Lateral line obsolete. Head resembling that of Belone, the head proper small, short, and rather broad, with flat top and vertical sides. Nostrils large close together in front of the eye, without tube or flap. Jaws excessively prolonged. almost needle-like, the upper the longer and somewhat recurved. in both jaws small, very numerous, close-set, retrorse. Gill-openings rather large, running downward and forward, separated by a narrow isthmus. Pectorals well developed. Vent close behind pectorals, the abdominal cavity extending far behind it. Anal fin beginning near the vent, higher than the dorsal, becoming obsolete on the caudal filament. Dorsal beginning close behind occiput, its anterior rays soft, succeeded by a long series of very low spines, which are slightly connected by membrane, their height rather less than the length of the interspaces; on the tail, the spines again give place to soft rays. The soft rays of the fins are connected by thin membrane instead of being imbedded in thick skin, as in eels generally. Color translucent, the lower parts dark, the back pale. Stomach not distensible. Muscular and osseous systems well developed. Abdominal cavity extending far behind the vent. One genus known, with three species; singular inhabitants of the deep seas. The position of this family among the Apodes is perhaps open to question. A second genus, Cyema Gthr., with shorter, soft body, posterior vent, and shorter vertical fins surrounding the tail, perhaps belongs to this family.

(Muranida, group Nemichthyina Günther, viii, 21.)

### 178.-NEMICHTINS Richardson.

(Leptorhynchus Lowe: Belonopsis Brandt.)

(Richardson, Voyage Samarang, 1848, 10: type Nemichthys scolopaccus Rich.)

Characters of the genus included above. (νζιμα, thread; λχθός, fish.)

## 592. N. scolopaceus Rich.

Head comparatively stout, its depth one-seventh its greatest length. Eye moderate, less than one-third the length of the head without snout. Length of pectoral fins slightly less than height of the anal, which is less than the height of the body and rather more than the greatest depth of the head. Pale above, belly and anal fin blackish, the color not abruptly changing, the back somewhat speckled. L. 36 inches. Atlantic Ocean, in deep water; many specimens lately taken with the beam-trawl off the New England coast.

(Richardson, Voyage Samarang, 10; Günther, viii, 21: Leptorhynchus leuchtenbergi Lowe = Beloropsis leuchtenbergi Brandt, Mém. Ac. St. Petersb. Sav. Étrang. 1854, 171-174.)

### 593. N. avocetta Jordan & Gilbert.

Head slenderer, its depth one-ninth its greatest length. Eye large, one-third the head, without snont. Length of pectoral scarcely greater than height of anal, which is scarcely less than the greatest depth of the body, and more than the greatest depth of the head. Translucent; belly with close-set dark spots, its lower edge and anal fin black, the back abruptly white and unspotted. L. 22 inches. Head 10; depth 58; depth of anal 64 in length of body. Puget's Sound; one example known, differing in some slight respects from all Atlantic specimens examined.

(Jordan & Gilbert, Proc. U. S. Nat. Mns. 1880, 409.)

# Sub-class PHYSOCLISTI.

(The Physoclistous Fishes.)

Air-bladder, if present, without pneumatic duct, in the adult. Parietal bones separated by the supraoecipital. Ventral fins usually thoracie or jugular, normally with 1 spine and 5 soft rays. Pectoral fin normally inserted high, with vertical base. Vertical fins usually with spines. Premaxillaries normally forming the entire border of the upper jaw. Tail homocereal. ( $\varphi v \sigma \dot{v}_5$ , bladder;  $z \lambda z \dot{v} \sigma \tau \dot{v}_5$ , closed.)

#### ANALYSIS OF THE ORDER OF PHYSOCLISTI.

- a. Scapula suspended to the anterior vertebræ; maxillary distinct; superior branchihyals and pharyngeals present; inferior pharyngeals not united; no interclavicles; body elongate; ventral fins abdominal or wanting.
  - Орізтномі, Р.
- aa. Scapula suspended to the eranium by a post-temporal.
  - b. Lower pharyngeals co-ossified; fins without spines; ventral fins abdominal; third and fourth superior pharyngeals much enlarged.
    - SYNENTOGNATIII, Q.
  - bb. Lower pharyngeals separate (or if united, fins with spines and ventrals thoracie).

    c. Gills tufted; superior branchihyals and pharyngeals and basal branchihyals wanting; ventrals, if present, abdominal.....Lophobranchi, R. cc. Gills pectinate.

    - dd. Superior branchihyals and pharyngeals normally developed; ventrals mostly thoracie or jugular.
      - e. Bones of the jaws not united.
        - f. Pectoral fins not pediculate, the gill-openings in front of them.

          - gg. Cranium anteriorly twisted; both eyes on the same side of the head.

# Order P.—OPISTHOMI.

(The Spiny Eels.)

Scapular arch suspended to the anterior vertebræ. Superior pharyngeals and branchihyals ossified, the third pharyngeal a little larger, the fourth small. Three basal branchihyals; inferior pharyngeals distinct; maxillary bone distinct; supraoccipital separating parietals; no interclavicles; symplectic present; præcoracoid wanting; parietals separated by the supraoccipital; air-bladder, if present, without pneumatic duct; dorsal with spines; ventrals, if present, abdominal. The fishes of this order differ from other *Physoclisti* and agree with the Eels in having the scapular arch free from the cranium and attached to the anterior vertebræ. Two families are known. ( $\delta\pi i\sigma\theta_{\eta}$ , backward;  $\delta\mu\sigma_{\xi}$ , shoulder.)

#### ANALYSIS OF FAMILIES OF OPISTHOMI.

a. Ventral fins wanting; dorsal fin with the soft portion well developed.

MASTACEMBELIDÆ, 56 (b).

# FAMILY LVI (b).—MASTACEMBELIDÆ.

(The Spiny Eels.)

Body elongate, eel-like, naked or covered with very small scales. Mouth oblique, of moderate size, either the snout or the chin being produced in a fleshy appendage; lower jaw little movable; upper jaw not protractile. Teeth small. Gill-openings restricted to the region below the convexity of the operculum, the upper part of the operculum being covered by the skin of the scapular region; gill-membranes free from the isthmus; gills 4, a slit behind the fourth. Pseudobranchiæ small or obsolete. Tail isocercal. Dorsal fin very long, the anterior part composed of low, free spines, the posterior of soft rays; anal fin with or without spines; candal fin separate or not. Ventral fins wanting; pectorals small. Air-bladder present. Branchiostegals 6; pyloric ecca 2 (in Mastacembelus). Fishes of the fresh waters of the East Indies. Genera 2; species about 14. We follow Dr. Bean in attaching provisionally to this family a singular fish from

the North Pacific, the osteology of which is unknown, and which may really belong to the *Acanthopteri*.

(Mastacembelidæ Günther, iii, 539-543.)

- a. Scales none or rudimentary; body very elongate, tapering backward to a point. (Ptilichthyina.)

#### 179.-PTILICHTHYS Bean.

(Bean, Proc. U. S. Nat. Mus. iv, 1881: type Ptilichthys goodei Bean.)

Body extremely elongate, serpentiform, little compressed, the tail tapering to a point. Skin naked, or with a few thin, loose, scattered scales: no lateral line. Head unarmed, rather small; upper jaw not protractile; snout short; mouth oblique; lower jaw projecting considerably beyond the upper, with a protruding fleshy appendage at tip. Maxillary reaching the front of eye. Mandible little movable. Both jaws with fine, close-set, sharp teeth, in one row, the posterior teeth a little the largest; no evident teeth on vomer or palatines. Gill-openings restricted to below the most convex part of the opercle; the membranes broadly united below, free from the isthmus. Gills 4, a slit behind the fourth. Pseudobranchiæ very small, almost obsolete. Gillrakers short and stout. Pectorals short; ventrals wanting; dorsal beginning close behind the nape; the anterior portion for about half the length of the body composed of very low, stiff, free spines, hooked backwards, the posterior portion higher, of slender soft rays connected by thin membrane. No caudal fin, the tip of the tail free. Anal similar to the soft dorsal, without spines. Vent at considerable distance from the head. North Pacific. (πτίλον, quill; λγθός fish.)

# 594. P. goodei Bean.

Orange or yellowish, the body with a blackish longitudinal stripe, the anal darker in color than the dorsal. Eye rather large, as long as snout, 5 in head; cheeks and opercles long; pectoral fin half as long as the head; soft dorsal and anal deeper than the body posteriorly, the anal a little lower than the dorsal. Vent near the end of the anterior third of the body; distance from the vent to the beginning of the soft dorsal  $3\frac{1}{4}$  times the length of the head; length of head twice its greatest depth,  $5\frac{1}{2}$  in the distance to the vent; appendage of mandible half as long as eye; free tip of caudal two-thirds eye. Dorsal spines 90; soft rays of dorsal 145; of anal about 185; P. 12. L. about 12 inches. Alcutian Islands.

(Bean, Proc. U. S. Nat. Mus. iv, 1881.)

Bull. Nat. Mus. No. 16——24

# FAMILY LVI (c).—NOTACANTHIDÆ.

(The Notacanthid Fishes.)

Body elongate, somewhat compressed, covered with very small scales; head scaly; lateral line present. Head short, the snout protruding beyond the mouth, which is of moderate size, horizontal; both jaws with a series of slender, close-set teeth. Eye lateral, rather small. Gill-openings wide, not restricted above, the membranes not united, free from the isthmus. Pseudobranchiæ none. Gill-rakers long, slender. Gills 4, a slit behind the fourth. Dorsal fin short, median, composed of a few very short free spines, with sometimes a single soft ray. Anal fin very long, moderately high, beginning near the middle of the body and extending along the lower side of the band-like tail, confluent with the small caudal; anteriorly with numerous spines. Ventrals abdominal, nearly median, of 2-4 inarticulate and about 8 soft rays; the fins very close to each other, and often completely united. Pectorals short, placed rather high. Genera 2, species about 6; deep-water fishes, found in most seas.

(Notacanthi Günther, iii, 544.)

### 180.-NOTACANTHUS Bloch.

(.1canthonotus Bloch: Campulodon Fabricius.)

(Bloch, Abh. der Böhm. Gesellsch. 1787: type Notacanthus chemnitzi Bloch = Acanthonotus nasus Bloch, Ausländische Fische, xii, 114: fide Gill.)

Snont not produced into a proboseis. Dorsal spines 12–15. Characters of the genus otherwise included above. (νῶτος, back; ακανθα, spine.)

### 595. N. chemmitzi Bloch.

Color plain, or with dusky bands on the back. First spine of the dorsal opposite the ventral fin; no soft ray in the axil of the last spine. Ventrals close together, and joined by the internal border of their membranes. Pectorals 13 times in the length of the fish; ventrals 22 times in length. Head 8 in length; depth 12. B. 8; D. X; A. XIII, 116; C. 8.; P. 17; V. III, 8. Lat. 1. 400. (Valenciennes.) Coast of Greenland. This or some other closely related species has been lately taken in deep water off the coast of New England.

("Notacanthus chemnitzi Bloch, Abh. der Böhm. Gesellsch. 1787": Acanthonotus nasus Bloch, Ausl. Fische, xii, 114: Acanthonotus nasus Bloch & Schneider, Syst. Ichth. 390: Notacanthus nasus Cuv. & Val. viii, 467: Notacanthus nasus Günther, iii, 54: Campylodon fabricii Reinh. Vidensk. Selsk. Afhandl. 1838, 120.)

# Order Q.—SYNENTOGNATHI.

(The Synentognathous Fishes.)

Lower pharyngeal bones fully united; second and third superior pharyngeals much enlarged, oval, not articulated to the cranium, sending processes forwards; the fourth wanting. Ventral fins abdominal, without spine, the rays more than 5. Scapula suspended to the cranium by a post-temporal bone, which is slender and furcate. Parietal bone much reduced. Supraclavicle not distinct; no interclaviele. Basis of cranium double in front, but without muscular tube. Fins without spines. Airbladder usually large, without pneumatic duct. This order includes only the family of Scomberesocidæ, and marks the transition from the Physostomi to the Acanthopteri. Its relations with the Haplomi are very intimate. (συν, together; εντοτ, within; γναθος, jaw.)

(Physostomi pt. family Scomberesocidae Günther, vi, 233-298.)

# FAMILY LVIL—SCOMBERESOCIDÆ.

(The Gar-fishes and Flying-fishes.)

Body oblong or elongate, covered with cycloid scales, which are usually deciduous. Lateral line running very low, along the sides of the belly. Head more or less scaly, usually with vertical sides. Mouth various, the jaws being often prolonged into a beak. Premaxillaries not protractile, hinged at base mesially; margin of the upper jaw chiefly formed by the premaxillaries; the short maxillaries often entering the lateral margin; maxillary often anchyclosed with the premaxillary; its edge slipping under the front of the preorbital. Dentition various. Dorsal fin without spines, inserted on the posterior part of the body, opposite the anal and usually similar to it. Ventrals abdominal, of several soft rays, usually inserted posteriorly. No adipose fin. Pectoral fin inserted high, sometimes used as an organ of flight. Caudal fin usually forked, the lower lobe the longer. Vent close in front of anal. Nostrils large, double, near the eye. Lower pharyngeals fully united. Gill-membranes not united, free from the isthmus. Pseudobranchiæ hidden, glandular. Gill-rakers various. Gills 4, a slit behind the fourth. Air-bladder usually large, sometimes cellular. Intestinal canal usually simple, without ecca. Carnivorous. One genus (Zenarchopterus) viviparous, the other oviparous. Genera about 8, species 160; abounding in all warm seas, some of them entering fresh waters.

(Scomberesocidæ Günther, vi. 233-298.)

- \* Jaws with sharp, wide-set teeth; both jaws prolonged, forming a beak; finlets none. (Beloninæ.)
- - b. Maxillary anelylosed to premaxillary.

    - cc. Lower jaw only produced: no finlets. (Hemirhamphina.)
      - d. Anal fin of the male not modified; species oviparous.
  - HEMIRIAMPHUS, 183. bb. Maxillary separate from premaxillary; neither jaw produced; no finlets;
    - pectoral fins elongate. (Exocutinue.)
      e. Ventrals anteriorly placed, not reaching to the anal. HALOCYPSELUS, 184.
      - ee. Ventrals posteriorly placed, reaching past front of anal.
        - f. Chin without barbel..... Executus, 185.
        - ff. Chin with one or two barbels or fleshy appendages. Cypselurus, 186.

### 181.-TYLOSURUS Cocco.

# Gar-fishes.

(Cocco, Lettere in Giornale Sci. Let. Sicilia, xvii, 18: type Tylosurus\* cantraini Cocco = Esox imperialis Raf.)

Body elongate, very slender, not much compressed. Both jaws prolonged into a beak, the lower jaw somewhat the longer, much the longer in young fishes, the very young resembling Hemirhamphus. Both jaws armed with a band of small, sharp teeth, besides which is a series of longer, wide-set, sharp, conical, unequal teeth. No teeth on vomer or palatines. Maxillaries grown fast to premaxillaries. Scales small, deciduous. Lateral line running along the side of the belly, becoming median on the tail. No finlets. Dorsal fin usually elevated anteriorly. Caudal fin short, truncate or forked. Pectorals and ventrals small, the latter inserted behind the middle of the body. Gill-rakers obsolete. Airbladder present. Ovary single. Bones usually green. Size comparatively large. Species numerous. Voracious fishes, found in most seas. This genus differs from  $Belone\dagger$  ( $Belone\ vulgaris\ Cuvier$ ) in the absence of gill-rakers and vomerine teeth. ( $\tau \delta \lambda v_5$ , callons;  $v \delta \rho a$ , tail; in allusion

<sup>\*</sup>We are informed by Dr. Vinciguerra, of Genoa, that the gill-rakers are obsolete in *Tylosurus imperialis*, as in all the American species formerly referred to *Belone*.

<sup>†</sup> Cuvier, Règne Anim. ii, 1817: type Esox belone  $L = Belone \ rulgaris$  Fleming. ( $\beta \epsilon \lambda \acute{o} r \eta$ , an ancient name of some fish whose "belly splits to allow the escape of the eggs, the wound afterwards healing," doubtless Syngnathus;  $\beta \acute{e}\lambda o \acute{s}$ , a dart.)

to the caudal keel, on which the genus was originally based, a character of little importance.)

- a. Caudal peduncle not keeled.
  - b. Posterior rays of the dorsal prolonged, longer than the anterior rays.

## **596. T. hians** (C. & V.) J. & G.

Olive green above, silvery below, sides with a row of obscure dusky blotches in the young; posterior portion of dorsal fin black. Snout a third longer than the rest of the head. Maxillary hidden by the preorbital. Dorsal beginning opposite front of anal, its posterior rays much elevated, their tips reaching beyond base of caudal. Anal fin slightly falcate, the last rays very low. Tail compressed, deeper than broad. Head 3 in length. D. 26; A. 27. Virginia to the West Indies and the west coast of Mexico, occasional on our coast.

(Belone hians Cuvier & Valenciennes, xviii, 432: Belone hians Günther, vi, 248.)

- bb. Middle and posterior rays of dorsal short, subequal.
  - e. Dorsal and anal long, each with more than 20 rays.

# 597. T. latimanus (Poey) J. & G.

Green above, white below. Head and body elongate. Eye 10½ in head. Beak twice as long as the rest of the head. Pectoral rather long and pointed, broader and shorter than in *T. longirostris*. Bones not green. Caudal forked. B. 24; D. 24; A. 25. Cuba; occasional on our Atlantic coast. (Buzzard's Bay; Goode.)

(Belone lațimana Poey, Mem. Cuba, ii, 292, 1860: Belone lațimanus Günther, vi. 249: Belone lațimana Goode, Proc. U. S. Nat. Mus. 1878, 6.)

ec. Dorsal and anal shorter, each with less than 20 rays.

d. Tail compressed, deeper than broad.

### **598. T. notatus** (Poey) J. & G.

Green above, yellow below; vertical fins bluish, their tips tinged with orange. Free portion of tail compressed, deeper than broad. Head flat above, with deep scaly median groove. Superciliary region striated. Base of premaxillaries depressed; maxillary hidden by the preorbital. Teeth moderate, wide-set; no vomerine teeth. Eye less than interorbital space,  $\frac{2}{5}$  the postorbital part of head. Body broad, subcylindrical. Pectoral as long as postorbital part of head; ventrals very small; anal scaly at base; caudal slightly emarginate. Scales rather large. Head  $2\frac{1}{2}$ . D. 13; A. 14. (Günther.) West Indies, north to West Florida.

(Belone notata Poey, Mem. Cuba, ii, 293, 1860: Belone notata Günther, vi, 248: Belone notata Goode & Bean, Proc. U. S. Nat. Mus. 1879, 151.)

dd. Tail depressed, broader than deep.

# 599. T. longirostris (Mitchill) J. & G.—Gar-fish; Bill-fish; Needle-fish.

Olive green above, silvery below; a silvery lateral stripe; a dark spot above root of pectoral; fins nearly plain. Free portion of tail moderately depressed, not keeled. Head long, flat above, with a broad, rather shallow, scaly median groove. Top of head not rugose, usually faintly striate. Maxillary rather more than half hidden by the preorbital. Teeth moderate; no vomerine teeth. Gill-rakers obsolete. Body subcylindrical, its depth less than the length of the pectoral, which is about equal to the postorbital part of the head. Ventrals a little nearer the head than the caudal; dorsal and anal somewhat falcate; caudal fin truncate, or slightly emarginate. Scales thin and small, decidnous. Head  $2\frac{3}{4}$ ; snout 4. D. 15; A. 18. L. 4 feet. Maine to Brazil; very abundant on our Atlantic coast. It often ascends rivers far above tide-water.

(Esox longirostris Mitch. Amer. Month. Mag. ii, 322, 1817: Belone truncata Le Sueur, Journ. Acad. Nat. Sci. Phila. ii, 126, 1821: Belone truncata Günther, vi, 244: Belone scrutator Grd. U. S. Mex. Bound. Surv. Iehth. 30.)

aa. Caudal peduncle keeled.

## 600. T. exilis (Grd.) J. & G .-- Needle-fish.

Translucent green, silvery below; an olivaceous vertebral streak and a bluish lateral band; fins plain. Body very slender; head long. Eye more than a third of the postorbital region. Maxillary not nearly all hidden by the narrow preorbital. Top of head flattish, with a broad scaly groove. Pectoral fin shorter than postorbital part of head, its length more than greatest depth of body; ventrals short, a little nearer head than caudal; dorsal and anal falcate, rather low, the anal beginning before dorsal and ending in front of its last ray; caudal fin unequally lunate. Scales very small and thin. Head 3½. D. 15; A. 17. L. 3 feet. Coast of California, from Point Concepcion southward; abundant.

(Belone exilis Girard, Proc. Acad. Nat. Sci. Phila. 1854, 149: Belone exilis Girard, U. S. Pac. R. R. Surv. Fish. 158: Belone exilis Giinther, vi, 238.)

### 182.—SCOMBERESOX Lacépède.

### Sauries.

(Sayris Rafinesque: Grammiconotus Costa.)

(Lacépède, Hist. Nat. Poiss. v, 344, 1803: type Scomberesox camperi Lac. = Esox saurus Walb.)

Body elongate, compressed, covered with small, thin, deciduous scales. Jaws more or less prolonged, sometimes forming a beak, provided

with very feeble teeth; lower jaw the longer. Maxillaries joined to premaxillaries. Pectorals and ventrals small; dorsal small, opposite anal; last 4-6 rays of dorsal and anal detached, forming finlets. No pyloric coca. Air-bladder large. Gill-rakers numerous, long and slender. Size rather small. Species 2 or more, ranging widely in the open sea. (Scomber; Esox.)

a. Jaws produced in a beak.

# 601. S. Saurus (Walb.) Fleming .- Saury; Skipper; Bill-fish.

Olive brown above, sides and below silvery; a distinct silvery band as broad as the eye bounding the dark of the back. Head broad above, narrowed below, tapering anteriorly to the very slender pointed beak; snout longer than the rest of the head. Fins all small; caudal fin forked; ventrals midway between base of caudal and front of eye. Head 3½ in length; depth 9. D. 9—VI; A. 12—VI; Lat. l. 110. L. 18 inches. Atlantic Ocean; rather common on both coasts, and found in the open seas.

(Esox saurus Walbaum, Artedi, Pisc. iii, 93, 1792; Scombercsox camperi Cuv. & Val. xviii, 464; Scomberesox scutellatum Le Suenr, Journ. Acad. Nat. Sci. Phila. ii, 132, 1821; Fleming, Brit. Anim. 184; Günther, vi, 257; Scomberesox storeri Storer, Hist. Fish. Mass. 315; ? Scomberesox rondeleti Günther, vi, 257.)

aa. Jaws scarcely produced, not forming a beak.

# 602. S. brevirostris Peters.

Dark green above, silvery below; sides with a lateral silvery stripe, bounded above by a dusky streak; upper fins mostly dusky; lower Body much elongate, compressed, widest above, the abdomen and lower edge of head trenchant. Upper jaw conical, not produced, ending in a very acute tip; lower jaw slightly longer, its tip produced for a very slight distance, and flexible; triangular portion of premaxillaries as long as broad; snout a little more than half length of rest of head; interorbital space flat; maxillary reaching front of orbit. Teeth very minute, in a single row in each jaw. Eye large, in front of middle of head. Pectoral fin somewhat emarginate, \( \frac{1}{3} \) length of head; ventrals small, far back, slightly nearer tip of snout than tip of lower lobe of caudal; dorsal inserted slightly behind front of anal; both fins low, the finlets small; caudal widely forked, the lobes equal. Scales small, deciduous, those on top of head forming an elliptical patch. Head 51; depth 9. D. 9-VI; A. 12-VI; Lat. l. ca. 125. L. 14 inches. Coast of California; rare.

(Peters, Monatsbericht Akad, Wiss. Berl. July, 1866, 521: ? Scomberesox saira Günther, vi, 258.)

#### 183.-HEMIRHAMPHUS Cavier.

# Half-beaks.

(Cuvier, Règne Anim, ii, 1817: type Hemirhamphus commersoni Cuvier.)

Body elongate, compressed, the dorsal outline parallel with that of the belly. Upper jaw short; lower jaw prolonged into a slender beak, bordered with membrane; premaxillaries forming a triangular plate, the teeth of which fit against the toothed portion of the mandible; maxillaries joined to premaxillaries. Teeth feeble, sometimes tricuspid. Gill-rakers rather long. Head covered above with large, shield-like scales. Scales large, decidnous. No finlets; caudal fin more or less forked, the lower lobe the longer; dorsal and anal similar, not modified in the males. Oviparous. Air-bladder large. No pyloric ecca. Young with the lower jaw short. Species numerous, in all warm seas, going in large schools. Size comparatively small. ( $\hat{\gamma}\mu\nu$ , half;  $\hat{\rho}\hat{a}\mu\psi\sigma_{\xi}$ , beak.)

a. Pectoral fins short; ventrals moderate. (Hemirhamphus.)

#### 603. II. unifasciatus Ranzani.

Greenish, sides with a well-defined silvery band, narrower than the eye, about as broad as a scale. Tip of lower jaw red. Lower jaw (from end of upper jaw)  $4\frac{1}{2}$ – $5\frac{1}{2}$  in total length from its tip to base of caudal. Head (without mandible)  $4\frac{1}{3}$  in length from tip of upper jaw. Premaxillaries broader than long. Eye about equal to interorbital space,  $\frac{2}{3}$  postorbital part of head. Ventrals nearly midway between eye and base of caudal. Dorsal and anal scaly. Caudal moderately forked, the middle rays being longer than the eye. Back not compressed. Head (with lower jaw)  $2\frac{3}{4}$ –3; depth  $7\frac{1}{2}$ . D. 14; A. 15; Lat. l. 54. L. 12 inches. Cape Cod to Panama and Indian Ocean; common on our South Atlantic coast.

(Ranzani, Nov. Comm. Acad. Sci. Inst. Bonon. 1842, v, 326, tab. 25; Günther, vi, 262: Hemirhamphus richardi Cuv. et Val. xix, 26.)

#### 604. II. rosæ Jordan & Gilbert.

Green, with a silvery lateral band, rather broader than a scale. A triple vertebral streak. Lower jaw dark reddish brown. Lower jaw (from tip of upper)  $4\frac{1}{2}$  in length from its tip to base of caudal. Head without mandible  $3\frac{4}{3}$  in length from tip of upper jaw. Premaxillaries about as broad as long. Eye less than interorbital space, about half postorbital part of head. Ventrals rather nearer tip of caudal than eye, midway between base of caudal and gill-opening. Dorsal and anal

fins not sealy. Caudal moderately forked, the middle rays being twice the length of the eye. Pectorals shorter than postorbital part of head. Ventrals a little shorter. Back broad. Head (with lower jaw)  $2\frac{2}{3}$ . D. 14; A. 14; Lat. l. 63. Southern California, not very common.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 335.)

aa. Pectoral fins very long; ventrals very short; body very slender. (Euleptorham-phus\* Gill.)

#### 605. II. longirostris Cuvier.

Olivaceous, sides silvery. Body extremely slender and elongated, much compressed, almost band-like. Back thin, subcarinate. Lower jaw very slender and long, much longer than the rest of the head. Teeth very feeble. Eye large, about equal to snout. Pectoral fins long and slender, half as long as mandible, more than one-fourth the length of the rest of the body. Upper rays of pectorals broad and compressed. Ventrals not longer than eye, inserted far back. Candal fin unequally forked, the lower lobe the longer. Head  $6\frac{9}{3}$ ; depth 10. Mandible about 3. D. 22; A. 19; V. 6. L. 18 inches. Cape Cod to Indian Ocean, in the open sea; rare on our Atlantic coast.

(Cuvier, Règne Anim.; Günther, vi, 276: Hemirhamphus macrorhynchus Günther, vi, 276: Euleptorhamphus longirostris Putnam, Proc. Bost. Soc. Nat. Hist. 1870, 238.)

### 184.-HALOCVPSELUS Weinland.

(Weinland, Proc. Bost. Soc. Nat. Hist. 1859, vi, 385: "type Exocatus mesogaster Mitch.")

This genus differs from Exocotus mainly in the anterior position and small size of the ventral fins, which terminate in advance of the anal fin, and are not used as organs of flight. Species not very numerous.  $(\tilde{a}\lambda_5, \sec_i; z^i\psi \epsilon \lambda o_5, a \text{ swallow.})$ 

### 606. H. evolans (L.) Weinl.

Olivaceous above, with dark specks; silvery below, with a bright blue lustre. Pectoral fins black above and behind, the lower border whitish. Snout obtuse and short, \(^3\) the diameter of the eye. Eye not large, 4\(^4\) in head, less than the width of the broad, rather convex, interorbital space. Distance from snout to first ray of ventral about equal to distance between root of ventrals and last ray of dorsal. Pectoral fins long, \(^4\) the length of the body, reaching the root of the caudal; second

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1859, 131: type Euleptorhamphus brevoorti Gill= Hemirkamphus longirostris Cuvier. (ἐυλέπτος, very slender; ῥαμφος, beak.)

ray of pectoral divided, third ray longest. Ventral fins not reaching nearly to vent. Dorsal inserted a little in advance of front of anal, its anterior rays not half so long as the head; 20 scales in front of dorsal and 6 between dorsal and lateral line. Gill-rakers long and slender. Head 4; depth 5½. D. 13; A. 13. Lat. l. 42; Vert. 25 + 19. In most warm seas, not rare on our Atlantic coast, where it spawns in summer.

(Exocatus evolans L. Syst. Nat. i, 521: Exocatus evolans Günther, vi, 282: Exocatus evolans Lütken, Vidensk. Meddel. Naturh. Foren. 1876, 102; Weinland, I. c.)

## 607. II. obtusirostris (Günther) J. & G.

Very similar to *II. evolans*, but with the dorsal fin inserted above or behind the first ray of the anal; the distance from the snout to the first ray of the ventrals less than the distance between the root of the ventrals and last ray of the dorsal; 7 to 8 rows of scales above the lateral line; fins more distinctly marked. D. 13; A. 13. Lat. l. 40. (*Lütken*.) Tropical seas, north to Louisiana.

(Exocatus obtusirostris Günther, vi, 283: Exocatus obtusirostris Lütken, Vidensk. Meddel. Naturh. Foren. 1876, 102.)

### 185 .- EXOCETUS Linnaus.

# Flying-fishes.

(Artedi; Linnieus, Syst. Nat.: type Exocatus volitans L.)

Body elongate, broad above, somewhat compressed. Head short, blunt, narrowed below. Mouth small. Jaws very short, about equal. Chin without barbel. Maxillaries not joined to the premaxillaries. Teeth very feeble or wanting. Eyes large. Gill-rakers moderate. Scales large, deciduous. No finlets. Dorsal fin short, opposite anal. Candal widely forked, the lower lobe the longer. Pectoral fins very long, reaching past the beginning of the anal, and serving as organs of flight, their great size enabling these fishes to sustain themselves in the air for some time.\* Ventral fins large, posteriorly inserted, also used as organs of flight. Air bladder very large. No pyloric cœca. Species numerous in all warm seas. (ἐξώzοιτος, sleeping out; the ancient name of these fishes, which were supposed to come out on the beach to sleep at night)

<sup>\*</sup>These fishes are enabled to sustain themselves in the air for upwards of a minute. Their movements are exceedingly rapid. Their impulse, apparently, comes mainly from the strong tail, which has a sculling motion in the water, by which they acquire a great velocity. When they first emerge from the water, the pectorals are spread and vibrate rapidly, like the wings of an insect, and the ventrals are closed. The motion of the pectoral is simultaneous with the motion of the tail, and is probably caused by the latter. When they reach a horizontal position in the air, the pectorals and ventrals are spread, and apparently used only to retain the impulse previously received.

# 608. E. californicus Cooper.—Flying-fish; Volador.

Steel-blue above and on both sides, belly abruptly silvery. Pectorals blackish, with the posterior edge paler; an obscure oblique pale band across lower part; caudal plain dusky; ventrals pale, partly dusky; dorsal rather pale, with a dusky blotch above. Body stoutish. iaw rather the longer: both iaws with minute teeth. Eye large, rather longer than shout, 3 in head, nearly equal to the diameter of the slightly concave interorbital space. Pectoral fin reaching past the dorsal and falling just short of the caudal. Second ray of pectoral divided. the third longest. Ventrals about reaching middle of anal, their length  $3\frac{1}{5}$  in body, their insertion midway between middle of opercle and base of tail. Anterior rays of dorsal half the length of the head; 43 rows of scales between occiput and dorsal, 7 between the dorsal and the lateral Head 5; depth 6; D. 12; A. 10; Lat. l. 58. L. 18 inches. Southern California; very abundant in summer about the Santa Barbara Islands.

(Cooper, Proc. Cal. Acad. Nat. Sci. 1864, 93; Günther, vi, 295.)

#### 609. E. noveboracensis Mitchill.

Dark bluish above; pectorals blackish, with the lower edge pale, in the young with two black bars; ventrals mesially blackish, the edges all white; candal lobes mesially dusky, the edges pale. Head short; snout very blunt, shorter than the very large eye, which is narrower than the broad, concave, interorbital space. Pectoral fins very long, reaching past the base of the caudal; second ray of pectoral divided; ventrals reaching considerably past anal; their insertion midway between the preopercle and the base of the caudal. Dorsal fin inserted opposite anal. Head  $4\frac{9}{3}$ ; depth  $5\frac{1}{2}$ . D. 11; A. 9. Lat. l. 42–48. North Atlantic; not rare on our coast.

(Mitchill, Amer. Month. Mag. ii, 233, 1817; DeKay, New York Fauna, Fishes, 230; ? Cuv. & Val. xix, 99.)

# 610. E. melanurus Cuv. & Val.

Bluish above, silvery below, the pectoral fin blackish, except a portion of its middle and inner edge; ventrals plain or nearly so. Head of moderate length, not very blunt, the interorbital space broad, wider than the eye and somewhat concave. Eye very large, longer than snout, 3 in head. Pectoral fin 12 in length, reaching past the base of the last dorsal ray and the tip of the last anal ray. Ventrals inserted midway between the posterior edge of the eye and the middle of the base of the caudal, their tips reaching nearly to the base of the last

analray; secondray of pectoral fin divided. Dorsal fin low, its insertion nearly opposite front of anal. Head 4; depth 6. D. 11; A. 9; scales 6-52-3. North Atlantic; occasional on our coast.

(?? Cuv. & Val. Hist. Nat. Poiss. xix, 101; said to have a black blotch on the upper part of the base of the tail, recalling the coloration of species of Sargus, a feature not noticed by us on any of our flying-fish.)

#### 611. E. exiliens Gmelin.

Bluish above, silvery below, sides with five broad, transverse bars; pectorals and ventrals irregularly banded and blotched with blue and black. Body very slender; snout short,  $\frac{1}{6}$  length of head. Dorsal and anal fins similar and opposite. Ventrals inserted slightly behind the middle of the body; pectorals  $1^2_3$  in length of body; second ray of pectorals extending beyond the membrane in a spine-like process. Ventrals 3 in length. Head 6 in total length with caudal. D. 12; A. 12. Lat. l. 48. (Goode.) Atlantic Ocean; a small species, possibly the young of some other.

(Gmelin, Syst. Nat. i, 1400, 1788; Günther, vi, 291; Goode, Bull. U. S. Nat. Mus. v, 64.)

#### 186.-CYPSELURUS Swainson.

# Bearded Flying-fishes.

(Cypsilurus Swainson, Classification of Fishes, 1839, 296: type Exocatus nuttalli Le Sueur.)

This genus differs from Exocœtus in the presence of one or more barbels or cutaneous appendages of delicate texture on the tip of the mandible. The species are all of small size, and it is possible that in some of them these appendages are lost with age.  $(zb\psi \epsilon \lambda \sigma \epsilon, a \text{ swift or swallow}; ob\rho \dot{a}, \text{tail.})$ 

## 612. C. furcatus (Mitch.) Weinland.

Barbels 2, ribbon-like, usually little if any longer than the eye. Eye large, narrower than the broadly, slightly concave, interocular space. Adult nearly plain; young with three broad, black bands across the belly in front of the ventrals; operculum and pectorals marbled with black; lower caudal lobe with three blackish cross-bands; posterior part of ventral and lower part of anal black. Ventrals and pectorals reaching past base of caudal; ventrals inserted nearer the root of the caudal than the snout; dorsal very high, higher than the body, the longest rays not reaching the caudal. Anal not low. Head 4 in

length, not very short nor very blunt. D. 13; A. 9. Atlantic Ocean; not very common on our coasts.

(Exocatus furcatus Mitch. Trans. Lit. and Phil. Soc. i, 449, 1815; Exocatus furcatus Günther, vi, 286: Exocatus nuttalli Le Sueur, Journ. Acad. Nat. Sci. Phila. 1821, 10: Exocatus nuttallii Günther, vi, 286: Exocatus furcatus Lütken, Vidensk. Meddel. Naturh. Foren. 1876, 106; Weinl. l. c.)

# 613. C. comatus (Mitch.) Weinland.

Greenish above, paler below; ventrals somewhat dusky; lower edge of pectorals pale. Body moderately elongate; head medium; eye very large, longer than snout, about 3 in head. Barbel very long, ribbon-like, reaching in the adult as far as the base of the ventrals; a small similar barbel, shorter than the eye, on each side of it at base. Pectoral fins reaching to last ray of dorsal, the third ray longest, the second split. Insertion of dorsal nearly midway between ventrals and anal; ventrals slightly nearer gill-openings than base of caudal, their tips nearly reaching end of anal, which is smaller than dorsal; caudal well forked, the lower lobe longest. Head 4; depth  $5\frac{2}{3}$ . D. 12; A. 9; Lat. l. 47. L. 8 inches. (Lütken.) Atlantic Ocean; oceasional on our coast.

(Exocætus comatus Mitch. Trans. Lit. and Phil. Soc. N. Y. i, 448: Exocætus comatus Günther, vi, 286: Exocætus comatus DeKay, New York Fauna, Fishes, 231: Exocætus appendiculatus Wood, Journ. Acad. Nat. Sci. Phila. 1824, 283: Exocætus comatus Lütken, Vidensk. Meddel. Natur. Foren. 1876, 106, fig. 1.

# Order R.—LOPHOBRANCHII.

(The Lophobranchs.)

Gills tufted, not laminated, composed of small rounded lobes attached to the gill-arches. Scapula suspended to the cranium by a post-temporal. Superior branchibyals and pharyngeals, and basal branchibyals wanting or not ossified. Mouth very small, bounded above by the premaxillaries. Post-temporal simple, co-ossified with the eranium; basis of the cranium simple. Pectoral fins with elevated bases. Interclavieles well developed. Anterior vertebræ modified, the diapophyses much expanded. Air-bladder simple, without air-duet. Snont produced, bearing the small toothless mouth at the end. Gill-covers reduced to a large simple plate. Skin with bony plates. Muscular system little developed. The families mentioned below have neither spinous dorsal, nor ventral fins; the *Solenostomatidæ* of the Indian Ocean have all the fins well developed. ( $\lambda \delta \psi \sigma z$ , crest;  $\beta p \delta \gamma \chi z a$ , gills.)

(Lophobranchii Günther, viii, 150-203.)

#### ANALYSIS OF THE FAMILIES OF LOPHOBRANCHIL

- a. No spinous dorsal fin: no ventral fins: gill-openings narrow.

  - bb. Axis of the head forming an angle with that of the body. HIPPOCAMPIDE, 59.

# FAMILY LVIII —SYNGNATHIDÆ.

# The Pipe-fishes.

Body elongate, very slender, covered with bony plates. Head slender, its axis continuous with that of the body. Snout long, tube-like, bearing the short toothless jaws at the end. Gill-openings reduced to a small aperture behind the upper part of the operele. Tail long, not prehensile, usually provided with a small caudal fin. Male fishes with an egg pouch, usually placed on the under side of the tail, sometimes on the abdomen, and formed of two folds of skin which meet on the median line. The eggs are received into this pouch and retained until some time after hatching, when the pouch opens, permitting the young to escape. Dorsal fin single, nearly median, of soft rays only; pectorals present, small; ventrals none; anal fin minute, usually present. Genera 10 or more; species 120. Small fishes, found in all warm seas, sometimes entering fresh waters.

(Syngnathida, group Syngnathina Günther, viii, 153-193.)

## 187.—SIPHOSTOMA\* Rafinesque.

(Syngnathus of most recent authors.)

(Rafinesque, Caratteri di alcuni Nuovi Generi, 18, 1810: type Syngnathus pelagicus L.)
Body elongate, very slender, six or seven angled, not compressed, tapering into a very long tail; the dorsal keels of the trunk not continuous with those of the tail. Head slender, tapering into a long tubelike, sub-terete snout, which bears the very short, toothless jaws at the end. Humeral bones firmly united with the "breast-ring." Body covered with a series of bony, keeled, radiated plates, arranged in linear series. Dorsal fin distinct, rather short, opposite the vent, which is near the middle of the body; caudal fin present, rather small; anal fin

<sup>\*</sup>The genus Syngnathus of Linnaus, originally equivalent to the modern order of Lophobranchii, was first subdivided by Rafinesque in 1810. The name Siphostoma was given to S. pelagicus, and its relatives, the Syngnathus of late writers, that of Tiphle to S. typhle, the Siphonostoma of late writers, while Syngnathus was retained for S. acquoreus and its relatives, the group now usually called Nerophis.

minute, close behind vent; pectorals developed, short and rather broad. Male fishes with an egg-pouch along the under side of the tail, formed by two cutaneous folds, and splitting lengthwise to extrude the young fishes. Species numerous, inhabiting all warm seas; abounding in bays among the sea-weeds, and entering the rivers. The species of this genus are subject to many variations, and their proper discrimination is very difficult. (GIGOR, tube: GZÓRA, mouth.)

a. Breast shields not covered by skin; lower jawprojecting. (Siphostoma.)
 b. Atlantic coast species.

# 611. S. fuscum (Storer) J. & G.—Common Pipe-fish.

Olivaceous; sides mottled and blotched as in other species; base of dorsal with darker spots. Muzzle shorter than the rest of the head. Occiput usually more or less keeled. Dorsal fin longer than the head, covering 4+5 rings. Distance from snout to dorsal 3 in total length. Belly in females searcely carinate. Tail one-third longer than rest of body. Lateral line and upper caudal edge not continuous. Head 9. D. 35-40. Rings 18+37. L. 10. Atlantic coast, common northward; described from specimens from Wood's Holl, Mass.

(Syngnathus fuscus Storer, Rept. Fish. Mass. 1838, 162: Siphonostoma fuscum Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 22: Syngnathus peckianus Storer, l. c. 163: Syngnathus peckianus Giinther, viii, 157: Syngnathus fasciatus and viridescens DeKay, New York Fauna, Fish. 319-321: ? Syngnathus affinis \* Giinther, viii, 164; from Louisiana.)

# 615. S. Iouisianæ (Günther) J. & G.

Color of other species; base of dorsal spotted. Muzzle longest in females, much longer than the rest of the head. Occiput somewhat keeled. Dorsal fin shorter than the head, on 3+5 rings. Distance from shout to dorsal 2\frac{1}{2} in total length. Belly in females scarcely

Another form or species has the body stonter and the color darker, the dorsal in the females very high, and blackish, with paler spots. Muzzle about equal to the rest of the head. Occiput somewhat carinated. Dorsal fin shorter than the head, on 3+5 rings. Distance from snout to dorsal  $2\frac{1}{2}$  in length. Belly in the females with a sharp black carina. Head 7. D. 30-31. Rings 15+33. Saint John's River, Florida.

(Siphonostoma sp. Jordan, Proc. U. S. Nat. Mus. 1880, 22.)

<sup>\*</sup> S. affinis (Giinther) J. & G.

<sup>&</sup>quot;The length of the snout is a little less than that of the remaining part of the head. Head nearly one-ninth of the total length. A distinct ridge runs along the median line of the snout and nuchal shields. Supraorbital ridge continued over the temples. Anterior part of the operenlum with a faint ridge. Shields without spines. Tail longer than body. Caudal pouch half as long as the body. Lateral line interrupted. Vent below the posterior third of the dorsal, which occupies 9 rings, 5 of which are body-rings. Caudal fin well developed; anal fin rudimentary in the male. Back with indistinct brown cross-bars; a brown band from the eye along the snout." Total length 6 inches. Head 10 lines. Trunk 1½ inch. Length to origin of dorsal fin 2 inches. Louisiana. (Günther.)

carinated. Tail one-fifth longer than the rest of the body. Lateral line and upper candal edge not continuous. Head 7. D. 33-37. Rings 18 + 33-20 + 38. L. 12 inches. Virginia to Texas; described from specimens from Beaufort, N. C.

(Syngnathus louisianæ Günther, viii, 160: Siphonostoma louisianæ Jordan, Proc. U. S. Nat. Mus. 1880, 22.)

bb. Pacific coast species.

# 616. S. californieuse (Storer\*) Gill.—Big Pipe-fish.

Olivaceous, varying to brownish red, yellowish below; head and body variously marbled and speckled with whitish, the markings posteriorly taking the form of short horizontal grayish streaks, anteriorly often forming narrow bars; usually a brownish lateral band. Top of head not carinated. Snont very long, from 1½ to 2 times the length of the rest of the head, its length proportionately greater in the adult, and usually greatest in males. Dorsal shorter than head. Lateral line not continuous with upper edge of tail. Belly not carinated. Opercle without ridge. Dorsal rays 42 (varying from 38 to 44). Rings 20 + 46 (those behind the vent varying from 40 to 48 in number; 40 to 43 in var. griscolineatum; 46 to 48 in var. californiense). L. 14 to 18 inches, much more than in our other species. Pacific coast of United States, everywhere common, especially northward.

(Syngnathus californiensis Storer, Proc. Bost. Soc. Nat. Hist. ii, 73, 1845: Syngnathus californiensis Gill, Proc. Acad. Nat. Sci. Phila. 1862, 283: Syngnathus griscolineatus Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 14: Syngnathus griscolineatus Giinther, vii, 160: Syngnathus abbotti Girard, U. S. Pac. R. R. Surv. Fish. 346: Syngnathus californiensis Girard, U. S. Pac. R. R. Surv. Fish. 344.)

# 617. S. leptorhynchus † (Girard) J. & G.

Yellowish brown or blackish, spotted or vermiculated. Head raised above, but usually not carinated. Snout  $1\frac{1}{2}-1\frac{3}{4}$  times the length of the rest of the head. D. 30-35. Rings 17+37-43. L. 10 inches. Other-

<sup>\*</sup>Another form or species, occurring at Monterey and Santa Barbara, agrees with the preceding in size, color, plates, fin-rays, &c., but differs in having the snout short not louger than the rest of the head. The eyes are rather smaller than in S. californiense, and the keels are perhaps less sharp.

<sup>†</sup>Another common form, which is probably a variation of this species, is— S. dimidiatum Gill.

Similar to S. leptorhynchus, but with the snout very short, scarcely as long as the rest of the head. Head slightly crested above. D. 30; rings 15 + 38. L. 8 inches. Coast of California, chiefly south of Point Concepcion.

<sup>(</sup>Syngnathus brevirostris Girard, Proc. Acad. Nat. Sci. Phila. 1854, 156 (name preoccupied): Syngnathus dimidiatus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 284: Syngnathus dimidiatus Günther, viii, 65.)

wise essentially as in S. californiense. Nuchal plates somewhat keeled in var. leptorhunchus: not keeled in var. arundinaceum. Coast of California, chiefly south of Point Concepcion; abundant.

(Syngnathus leptorhynehus Girard, Proc. Acad. Nat. Sci. Phila, 1854, 155; Syngnathus leptorhynchus Girard, U. S. Pae, R. R. Surv. Fish, 346; Syngnathus leptorhynchus Gill, Proc. Acad. Nat. Sci. Phila, 1862, 284; Syngnathus arundinaccus Girard & Gill, Il. cc.,)

aa. Breast shields covered by loose skin; lower jaw included. (Dermatostethus\* Gill.)

## 618. S. punctipinne (Gill) J. & G.

Brown; dorsal fin speckled. Body comparatively robust moderate, a little longer than the rest of the head. Eve large. Occiput with a raised keel; joint between the occiput and the first dorsal shield more perfect than usual, so that the head can be placed at an angle with the body. Greatest depth about equal to length of post-orbital part of head. Skin on breast and anterior ventral plates thin, showing the striation of the bones. Tail twice as long as trunk. Head 8: D. 41: rings 19 + 39. L. 12. San Diego, Cal. Only the original types known. (Dermatostethus punctipinuis Gill, Proc. Acad. Nat. Sci. Phila. 1892, 283.)

# FAMILY LIX.—HIPPOCAMPIDÆ

(The Sea Horses.)

Syngnathoid fishes destitute of caudal and ventral fins, and with the tail prehensile. Form of the body and head singular; in the typical genera the body is compressed, and the head, which is placed nearly at right angles with the axis of the body, is surmounted by a bony These little fishes have thus a remarkably horse-like physiognomy, like that of the conventional "knight" at chess. Mouth very small, terminal. Dorsal fin median, of soft rays only; anal fin minute: pectoral short, with a broad base. Gill-openings very small. Egg-pouch of the male usually at the base of the tail. Genera about 4; species about 30, most of them belonging to Hippocampus. Fishes of the open seas of warm regions. They attach themselves by their tails to seaweed and other floating substances, and are often carried to great distances by currents.

(Synguathidy, group Hippocampina Giinther, viii, 194-206.)

a Body compressed; occiput with a narrow bony crest, which is surmounted by a 

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1862, 283: type Dermatostethus punctipinnis Gill.  $(\delta \varepsilon \rho \mu \alpha, \text{ skin}; \delta \tau \varepsilon \theta \delta \delta, \text{ breast.})$ 

Bull. Nat. Mus. No. 16——25

## 188.-HIPPOCAMPUS Rafinesque.\*

Sea Horses.

(Rafinesque, Indice d'Ittiologia Siciliana, 1810, 37: type Syngnathus hippocampus L. = Hippocampus heptagonus Raf.)

Body strongly compressed, the belly gibbous, tapering abruptly to a long, quadrangular, prehensile tail. Head with a distinct curved neck, placed nearly at a right angle with the direction of the body, surmounted by a compressed occipital crest, on the top of which is an angular, star-shaped coronet; top and sides of the head with spines. Body and tail covered with bony plates, forming rings, those on the body each with 6 spines or tubercles, those of the tail with 4. Pectoral fins present; anal minute, usually present; dorsal fin moderate, opposite the vent. Egg-pouch in the male a sac at the base of the tail, terminating near the vent. Species numerous, in all warm seas. ( $i\pi\pi\delta z a\mu\pi\sigma s$ , the ancient name, from  $i\pi\pi\sigma s$ , horse;  $z\dot{a}\mu\pi\sigma s$ , a wriggling sea-monster, or a caterpillar.)

# 619. H. heptagonus Raf.—Sea Horse.

Yellowish brown; eyes and cheeks with radiating wavy lines of light brown; snout with a narrow white cross-band near its middle (fide Goode); sides with a few small pale spots; dorsal dusky above. Tubercles of body and tail prominent, slightly recurved, usually provided with slender filaments, the tubercles of each alternate or each third ring on the back usually larger than the others. Occipital crest very high, with 5 tubercles, the anterior with long filaments. Snout as long as the opercle, which is marked with radiating striæ. D. 18; P. 18; A. 4. Rings 11 + 36. L. 5 inches. Warmer parts of the Atlantic; north to England and Newfoundland; rather rare on our coast. Very abundant in the Mediterranean. European examples examined by us are profusely spotted, the snout plain; ours is possibly a different species.

(Syngnathus hippocampus L. Syst. Nat.; Rafinesque, l. c. 37: Hippocampus antiquorum Leach, Zoöl. Misc. 1814, 104: Hippocampus antiquorum Günther, viii, 200: Hippocampus antiquorum Goode, Proc. U. S. Nat. Mus. 1878, 45: Hippocampus brevirostris Cuvier, Règue Auim.: Hippocampus hudsonius DcKay, N. Y. Fauna, Fishes, 322: Hippocampus hudsonius Storer, Hist. Fish. Mass. 416: ? Hippocampus lævicuudatus Günther, viii, 205, "tail without knobs.")

#### 620. H. ingens Grd.

Chestnut brown, mottled with darker, and dotted with white. Body rather slender, its depth about equal to the distance from snout to pos-

<sup>\* =</sup> Hippocampus Leach, Zool. Misc. 1814, 103.

terior margin of orbit; tail longer than head and body together; snont rather shorter than opercle; supraorbital spine nearly half diameter of eye; coronet well developed, with five spines. D. 19; A. 4. Rings 10 + 38. San Diego, Cal., and southward; reaching a length of nearly a foot.

(Girard, U. S. Pac, R. R. Surv. Fishes, 1858, 342.)

# Order S.—HEMIBRANCHII.

(The Hemibranchs.)

Superior branchihyal and pharyngeal bones reduced in number; inferior pharyngeals separated. Ventral fins abdominal or subabdominal. Mouth bounded above by premaxillaries only; interclavicles developed. No pneumatic duct to the air-bladder. (Cope.) There are also several striking peculiarities in the structure of the shoulder girdle and the skull, by which these fishes differ from the Acanthopteri, with which group under one name or another they have usually been combined. ( $\hat{\gamma}\mu_i$ , half;  $\hat{\beta}\rho\hat{\alpha}\gamma\chi_i\alpha$ , gills.)

#### ANALYSIS OF FAMILIES OF HEMIBRANCHIL

- \*Bones of head produced into a long tube, which bears the short jaws at its end.
  - a. Body short, compressed, scaly; no teeth; spinous dorsal present.

CENTRISCID.E. 60.

- aa. Body clongate; teeth present.
  - b. Dorsal spines none; a long caudal filament; no scales.....Fistularide, 61.
  - bb. Dorsal spines present, disconnected; no caudal filament.

# FAMILY LX.—CENTRISCIDÆ.

(The Snipe-fishes.)

Body compressed, oblong or elevated, covered with small rough scales; no lateral line; some bony strips on the side of the back and on the margin of the thorax and abdomen, the former sometimes confluent into a shield. Bones of the skull much prolonged anteriorly, forming a long tube which bears the short jaws at the end; no teeth. Gill-openings wide; branchiostegals 4. Two dorsal fins, the first of 4 to 7 spines, the second of which is very long and strong; soft dorsal and anal moderate; ventral fins small, abdominal, of 5 soft rays; pectorals short; candal fin emarginate, its middle rays not produced. Air-bladder large; pseudo-

branchiæ present. Gills 4, a slit behind the fourth. No pyloric cœca; intestinal canal short. A single genus of three or more species, chiefly of the Old World, one of them straying to America.

(Centriscida part, genus Centriscus Günther, iii, 518-524.)

#### 189.—CENTRISCUS Linneus.

Snipe-fishes.

(Linnæus, Syst. Nat. 1758: type Centriscus scolopax L.)

The characters of the genus are included above. (χεντρίσχος, an ancient name of some spinous fish; from χέντρον, a spine.)

621. C. scolopax Linn.—Snipe-fish; Trumpet-fish; Bellows-fish.

Rose red or reddish olive above, silvery on the sides and belly. Body strongly compressed and somewhat elevated, covered with small striated scales, each stria terminating in a rather strong spine; second dorsal spine very strong, serrated posteriorly, its length about  $\frac{1}{6}$  total length of fish; snout several times longer than the rest of the head. Head  $2\frac{1}{2}$  in length; depth  $3\frac{1}{2}$  to 4. D. V-12; A. 20. Mediterranean Sea; occasional northward; accidental on our coast.

(Linn. Syst. Nat.; Günther, iii, 518.)

# FAMILY LXI.—FISTULARIIDÆ.

(The Trumpet-fishes.)

Body extremely elongate, much depressed, broader than deep. No scales. Bony plates present on various parts of the body. Head very long, the anterior bones of the skull much produced, forming a long tube, which terminates in the narrow mouth; both jaws, and usually the vomer and palatines also, with minute teeth; membrane uniting the bones of the tube below, very lax, so that the tube is capable of much dilation. Branchiostegals 5-7; gills 4, a slit behind the fourth. Gill-membranes separate, free from the isthmus; gill-rakers obsolete. Pseudobranchiæ present. Air-bladder large. Spinous dorsal fin entirely absent; soft dorsal short, posterior, somewhat elevated; anal fin opposite it and similar; caudal fin forked, the middle rays produced into a long filament; pectorals small, with a broad base, preceded by a smooth area as in Gasterosteida; ventral fins very small, wide apart, abdominal, far in advance of the dorsal, composed of 6 soft rays. Pyloric cœca few; intestines short. Vertebræ very numerous (4 + 49 + 33). Fishes of the tropical seas, related to the Sticklebacks in structure, but

with prolonged snout and different ventral fins. A single genus, Fistularia, with two or more species.

(Fistularida, part, genus Fistularia Günther, iii, 529-535.)

### 190 .- FISTULARIA Linnaus.

# Trumpet-fishes.

(Linn:eus, Syst. Nat. 1758: type Fistularia tabaccaria L.)

Characters of the genus included above. The bony shields, characteristic of this genus, are thus enumerated by Dr. Günther:

- "1. A narrow strip along the median line of the back behind the skull (confluent neural spines).
- "2. The pair of broader lateral dorsal shields are peculiar bones, separated processes of the occipital bone—similar to those we have observed in Mugil, where, however, they are not separated from the occipital, and arise more outwardly than in Fistularia. These shields are the longest, provided anteriorly with a ridge, which is prolonged and extends far backwards between the muscles of the back. This ridge is flexible, and does not interfere with the lateral movements of the fish; it appears to serve as a base for the attachment of muscular fibres.
- "3. The narrow shield on the side is the coracoid, and composed of two bones, the posterior of which is somewhat dilated and fixed to the lateral dorsal shields.
- "4. The ventral shields are the pubic bones; their posterior half is broadest, porous inferiorly; they are narrower before the middle, leaving a free lanceolate space between them, and are again a little widened anteriorly, where they join the humerus and nrohyal." (Günther, iii, 532.) (Latin, fistula, a tube or pipe.)
- a. Skin covered with dermal ossifications.

#### 622-F. tabaccaria Linn. - Trumpet-fish.

Reddish brown above, variegated with numerous blue spots on the sides and back. Mouth slightly oblique, lower jaw the longer, overlapping the upper; snout much prolonged, tapering but little forward; its edges with fine serrations or none. Margin of orbit with sharp compressed points in front and behind. Mandible about 4 in snout; snout  $3\frac{3}{4}$  in length of body. Head  $2\frac{1}{5}$ . D. 14; A. 13. Warm seas; occasional on our South Atlantic coast.

(Linn. Syst. Nat.; Günther, iii, 529.)

aa. Skin smooth, without dermal ossifications.

# 623. F. serrata Cuvier.

Grayish; sometimes with a series of blue spots along the back or sides; head silvery below. Form much as in the preceding, but head and body broader and more depressed; edges of snont more distinctly serrated, a foramen in the axil of pectoral. Snont  $3\frac{3}{5}$  in length. Head  $2\frac{3}{3}$ . D. 14; A. 13. Warm seas; rare northward; perhaps the same as the preceding.

(Cuvier, Règne Anim. 1817; Günther, iii, 533.)

# FAMILY LXII.—AULOSTOMATIDÆ.

(The Flute-mouths.)

Body compressed, clongate, covered with small ctenoid scales. Lateral line continuous. Head long; month small, at the end of a long, compressed tube. Lower jaw prominent, with a barbel at the symphysis. Premaxillary feeble, not protractile; maxillary broad, triangular, with a supplemental bone. Teeth minute, in bands, on lower jaw and vomer. Branchiostegals 4. Gills 4, a slit behind the fourth. Pseudobranchiæ well developed. Gill-rakers obsolete. Gill-membranes separate, free from the isthmus. Air-bladder large. Spinous dorsal present, of 8–12 very slender free spines. Soft dorsal and anal rather long, similar, posterior. Caudal small, rhombic, the middle rays longest, but not produced into a filament. Ventrals abdominal, of six rays, all articulated. Pectorals broad, rounded, the space in front of them scaly. Two pyloric eœca. A single genus, with two species, found in tropical seas. (Fistularidæ pt. genus Aulostoma Günther, iii, 535–538.)

# 191.—AULOSTOMA Lacépède.

(Lacépède, Hist. Nat. Poiss. v, 357, 1803: type Fistularia chineusis L.)

Characters of the genus included above. (αυλος, tube; στόμα, month.)

# 624. A. maculatum Val.

Olivaceous, with one or two series of brown or blue dots along each side of the back; another irregular series from the preoperculum along each side of the belly to the anal fin; three or four silvery lines on each side of abdomen, replaced on the head by irregular oblique streaks; anterior part of dorsal and anal with a horizontal black streak; caudal fin usually with two round black spots; ventral fins plain. D. X-23; A. 25; V. 6. (Günther.) Caribbean Sea, north to Southern Florida; probably identical with A. chinense.

(Valenc. in Cuv. Règne Animal, 1817: Aulostoma coloratum Müller & Trosch. Schomb. Hist. Barbad. 1848, 673: Aulostoma coloratum Günther, iii, 536.)

# FAMILY LXIII - AULORHYNCHIDÆ

Body elongate, nearly cylindrical, with a very slender, depressed caudal pedancle. Skin naked, with a few series of partly concealed plates. Mouth terminal, small, at the end of a tube which is about as long as the rest of the head; teeth very small; branchiostegals 4. Gill-membranes slightly connected, free from the isthmus. Dorsal fin with many small, low, free spines, each of which is depressible in a groove; soft dorsal short, elevated in front; anal similar to the second dorsal, preceded by a single spine; caudal fin small, forked. An oblong, naked area in front of the pectorals. Ventrals thoracic, but inserted somewhat behind pectorals, I, 4, or I, 5. Genus 1; species 2. Small fishes of the North Pacific, intermediate between the Sticklebacks and the Trumpet-fishes.

(Autorhynchidae Gill, Proc. Acad. Nat. Sci. Phila. 1832, 233.)

a. Skin of head naked; ventrals I,5; pectoral fins emarginate... Auloritynchus, 192.

#### 192.—AULOERINNCHUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 169: type Autorhynchus flavidus Gill.)

Body very long and slender, almost cylindrical; caudal peduncle elongate, tapering, much depressed, especially posteriorly. Skin naked, with a series of small, rugose shields, one on each side of the lateral line, one on each side of the dorsal fin, and a double row on the lower edge of caudal peduncle. Lateral line present. Head not mailed. Mouth small, horizontal, at the end of a tube which is slightly longer than the rest of the head. Premaxillary bones much expanded, with long and slender processes; lower jaw projecting, with a flap at symphysis. Teeth in the jaws rather sharp, almost in one series; palate toothless. Dorsal spines numerous, entirely separate, equal and very short, the first inserted above the pectorals. Dorsal and anal fins posterior, nearly equal, oblong, elevated in front; caudal fin small, emarginate; pectoral fins emarginate, the upper and lower rays longest; ventrals not much behind pectorals, each with 1 spine and (4) 5 rays.  $(ao\lambda \sigma_5, a tube; \rho \sigma_7 \chi \sigma_5, snout.)$ 

a. Lateral shields imbedded, not spinous. (Autorhynchus.)

#### 625. A. flavidus Gill.

Tawny, with about 20 darker cross blotches on the back; minutely punctulate above; opercula and ante-pectoral region with bright golden or coppery lustre, bordered above by a blackish band. Gill rakers slen-

der. Dorsal spines minute, much shorter than pupil. Caudal peduncle longer than head. Head 4; depth 16. D. XXV-9; A. I, 9; V. I, 5. Pacific coast, from Monterey northward; not rare.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 169: Auliscops spinescens Peters, Berlin Monatsbericht, 1866; Steind. Ichthyol. Beitr. v, 153.)

# FAMILY LXIV.—GASTEROSTEIDÆ.

(The Sticklebacks.)

Body elongate, somewhat compressed, tapering behind to a slender candal peduncle. Head rather long, the auterior part not produced into Month moderate, with the cleft oblique, the lower jaw promi-Teeth sharp, even, in a narrow band in each jaw; no teeth on vomer or palatines. Premaxillaries protractile. Preorbital rather broad; suborbital plate large, often covering the anterior part of the cheeks, forming a connection with the preopercle. Branchiostegals 3. Gill-membranes broadly joined, free from the isthmus, or not; gill-rakers moderate or rather long. Opercles unarmed. Skin naked or with vertically oblong bony plates; no true scales. Dorsal fin preceded by two or more free spines; anal similar to soft dorsal, with a single spine; ventral fins subabdominal, consisting of a stout spine and a rudimentary ray. Middle or sides of belly shielded by the innominate bones. torals short, unusually far behind the gill-openings, preceded by a quadrate naked area, which is covered with shining skin. Caudal fin narrow, usually lunate. Air-bladder simple; a few pyloric ceca. era 3, Gasterosteus, Apeltes, and Spinachia. Species about 20. fishes inhabiting the fresh waters and arms of the sea in Northern Europe and America; noted for their pugnacity. They are exceedingly destructive to the spawn and fry of larger fishes

"It is searcely to be conceived what damage these little fishes do, and how greatly detrimental they are to the increase of all the fishes among which they live, for it is with the utmost industry, sagacity, and greediness that they seek out and destroy all the young fry that come their way." (Günther.) Most of the Sticklebacks build elaborate nests which the male fish defends with much spirit.

(Gasterosteidæ Günther, i, 1-7.)

#### 193.—GASTEROSTEUS Linnaus.

### Sticklebacks.

(Artedi; Linnæns, Syst. Nat. x, 1758: type Gasterosteus aculcatus L.)

Sticklebacks with the innominate bones coalescent on the median line of the belly, behind and between the ventral fins, forming a triangular or lanceolate plate. Tail slender, keeled or not. Skin naked or variously covered with bony plates. Dorsal spines 2–10 in number, variously developed. Species numerons. Fresh waters and shores of all northern regions.  $(\gamma a \sigma \tau \dot{\eta} \rho, \text{ belly}; \dot{\sigma} \sigma \tau \dot{t} \sigma \rho, \text{ bone.})$ 

The group may be divided into the following sections, which are perhaps of generic value:

- a. Gill-membranes posteriorly free from the istlimus.
  - b. Dorsal spines 7-11, divergent (Pygosteus Brevoort).....pungitius,
- bb. Dorsal spines 5, in a right line (Eucalia Jordan) .....inconstans.
- aa. Gill-membranes not free from the isthmus; body more or less mailed (Gasterosteus).
  microcephalus, biaculeatus, atkinsi, aculeatus.
- a. Gill-membranes posteriorly free from the istlinius.
  - b. Dorsal spines 7-11, divergent (Pygosteus\* Brevoort).

## 626. G. pungitius L .- Nine-spined Stickleback.

Olivaceous above, profusely punctulate, irregularly barred with darker. silvery below. Body very slender, somewhat compressed, tapering into the very long and slender caudal peduncle, which is much depressed and strongly keeled, broader than deep. No dermal bony plates; skeletal plates not all covered by skin. Post-pectoral plate well developed, striated. Head shortish, the snout rather blunt. Thoracic processes well developed, widely divergent, forming a U-shaped figure Dorsal spines moderate, the anterior diverging to the right or left at various angles, the posterior more nearly erect. Anal spine large, larger than the dorsal spines. Innominate bone feeble, lanceolate, not carinated, its edges raised. Ventral spines moderate, serrulate, their length more than one-third that of the head. Gill-rakers long and slender; gillmembranes free from the isthmus posteriorly. Head 4; depth 5-6. D. IX, I, 9; A. I, 8. L. 3 inches. Northern parts of Europe, Atlantic coasts of America, Great Lakes, and northward; a widely distributed species, found in both fresh and salt water.

(Linnens, Syst. Nat.; Gunther, i, 6: Gasterosteus occidentalis Cuvier & Valenciennes, iv, 509: Gasterosteus dekayi Agassiz, Lake Superior, 311 (Massachusetts): Gasterosteus

<sup>\*</sup> Brevoort, MSS. Gill, Canadian Naturalist, August, 1865: type Gasterosteus occidentalis C. & V. = Gasterosteus pungitius L.  $(\pi v y)$ , rump;  $\delta \sigma \epsilon \delta v$ , bone.)

nebulosus Agassiz, Lake Superior, 1850, 310: Gasterosteus concinuus Richardson, Fauna Bor.-Amer. Fishes, 57 (Saskatchewan River and Great Bear Lake; D. VII-I, 9; A. I, 8): Gasterosteus mainensis Storer, Bost. Journ. Nat. Hist. i, 464 (Maine; D. VII-I, 9; A. I, 8). The two last perhaps represent a distinct subspecies, distinguished by the presence of 7 free dorsal spines.)

# Subs. brachypoda Bean.

Similar to *pungitius*, but the ventral spines very short, their length a little less than one-third that of the head. D. X-I, 10; A. I, 10. Baffin's Bay to Alaska; abundant.

(Bean, Bull. U. S. Nat. Mus. xv, 129, 1879.)

bb. Dorsal spines about 5, in a right line (Eucalia \* Jordan).

### 627. G. inconstans Kirt.—Brook Stickleback.

Males in spring jet black, tinged with red anteriorly; females and young olivaceous, mottled, and dotted with black. Body moderately elongate, little compressed, the caudal peduncle comparatively stout, not keeled. Skin smooth, entirely destitute of dermal plates, the skeletal plates covered by it. Innominate bone small, lanceolate, covered by the skin. Space in front of pectorals small; thoracic processes very slender and widely separated, covered by skin. Gill-membranes somewhat free posteriorly; gill-rakers short. Dorsal spines four or five, low, subequal, in a right line, a cartilaginous ridge running along the base of the fin; anal spine similar to dorsal spines; ventral spines short and sharp, serrated. Head 3½; depth 4. D. IV-I, 10; A. I, 10. L. 2½ inches. New York to Kansas and Greenland, in fresh waters only; abundant in the Great Lake region.

(Kirtland, Bost. Journ. Nat. Hist. iii. 273, 1841: Gasterosteus micropus Cope, Proc. Acad. Nat. Sci. Phila. 1865, 81: Eucalia inconstans Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 65: Gasterosteus pygmæns Agassiz, Lake Superior, 1850, 314, from Lake Superior; this is perhaps a distinct species, differing in the small number of fin-rays; D. III, I, 6; A. I, 6. Eucalia inconstans var. cayuga Jordan, Man. Vert. 1876, 249; specimens from Cayuga Lake, N. Y., with compressed and elevated body, slenderer tail, and higher spines: ? Gasterosteus williamsoni† Girard, U. S. Pac. R. R. Exp. and Surv. x, 94.)

aa. Gill-membranes not free from the isthmus; body more or less mailed. (Gasterosteus.)

c. Tail naked, not keeled. ‡

<sup>\*</sup> Jordan. Man. Vert. E. U. S. 1876, 248: type Gusterosteus inconstans Kirtland. ( $\varepsilon \dot{\nu}$ , well;  $\kappa \alpha \lambda i \alpha$ , nest.)

tOlivaceous brown, darker above; sides spotted with black; belly yellowish; head 3 in length; depth 5 in total length; eye  $3\frac{1}{2}$  in length of head; tip of first dorsal spine not reaching the base of the second. D. III-I, 10; A. I, 7. (Giverd.) Williamson's Pass, California. This form may differ from G. inconstans in the smaller number of dorsal spines.

Several recent writers have indicated their belief that the naked-tailed sticklebacks are simple varieties of the ordinary species. This may be true, but we have not yet met with distinctly intermediate forms, either on the Atlantic or Pacific coast.

### 628. G. microcephalus Girard.

Olivaceous, silvery below; skin thickly punctulate; males blackish in spring, with coppery or golden lustre. Body short, deep, moderately compressed. Caudal pedancle rather deep and compressed. Posterior part of body unarmed. Processes from shoulder-girdle below widely diverging, leaving a triangular area on the breast; naked area in front of pectorals small. Ventral spines serrate, without distinct basal cusp. Spines of soft dorsal and small. Immominate bone lanceolate, twice as long as bread. Dorsal spines attached to bony plates, as in *G. aculcatus*. Head 3; depth 3<sup>3</sup><sub>4</sub>. D. II-I, 11; A. I, 8. Lateral plates, 4 to 6. Pacific coast of the United States, ascending streams, abundant southward.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 133; Gasterosteus plebeius and inopinatus Girard, I. c. 147; Gasterosteus pugetti, Girard, U. S. Pac. R. R. Surv. Fish. 92.)

### 629. G. binenlentus Shaw.

Closely related to the preceding, but rather larger; the innominate bone triangular, two-thirds as broad as long. Ventral spine with a distinct basal cusp on its outer edge. D. H-I, 12; A. I, 9. Northern Europe and United States from Cape Cod northward. Considered by most European writers as a variety of *G. aculeatus*.

(Shaw, Gen. Zool. iv, 608, 1805; Günther, i, 5: Gasterosteus gymnurus Cuvier, Règne Anim.: Gasterosteus leiurus Cuv. et Val. iv, 481: Gasterosteus eurieri Girard, Bost. Journ. Nat. Hist. vi, 254; Gasterosteus aculeatus trachurus Goode & Benn, Bull. Essex Inst. 1879, 5: Gasterosteus wheatlandi Putnam, Proc. Essex Inst. 1837, 4.)

aa. Tail keeled, armed with plates.

#### 630. G. atkinsii Bean.

Reddish, silvery below and with dark bands across the body. Body slender, as in *G. pungitius*. Lateral plates 15 in number, the posterior very thin, covered by skin. Tail keeled. Ventral spines long, nearly or quite reaching the vent; dorsal spines in a straight line. Head 3\frac{1}{3} in length; depth 5. D. II-I, 11; A. I, 8. (*Bean.*) Schoodie Lakes, Maine.

(Bean, Proc. U. S. Nat. Mus. 1879, 67.)

#### 631. G. aculeatus L.—Common Stickleback; Burnstickle.

Dark greenish above; sides silvery, or yellow; membranes of ventrals often red. Head rather long. Caudal peduncle very slender, covered with plates similar to those on the body, and provided with a conspicuous keel. Processes from shoulder girdle below, covering most of the breast, leaving a narrow naked area between them. Opercle finely striate. Large rugose bony plates on each side of base of dorsal spines, the latter joined to them by a hinge and capable of being firmly set, like

the spines of cat-fish. Naked area in front of pectorals large. Pelvic bone lanceolate. Ventral spine with a basal cusp. Spines all serrate, those of anal and soft dorsal small. Head  $3\frac{1}{2}$ ; depth  $4\frac{1}{2}$ . D. II-I, 13; A. I, 9. Lateral plates 33. L. 4 inches. North Atlantic; very abundant on both coasts.

(Linn. Syst. Nat. Giinther, i, 4: Gasterosteus noreboraecusis Cuv. & Val. iv, 502: Gasterosteus biaeuleatus Storer, Hist. Fish. Mass. 40; Gasterosteus biaeuleatus et noreboraecusis DeKay, New York Fauna, Fish. 65, 63: Gasterosteus niger Cuv. & Val. iv, 504; Gasterosteus trachurus Cuv. & Val. iv, 481: Gasterosteus bispinosus Walbaum, Artedi Pisc. 1792, 450, the oldest American name.)

Subsp. cataphractus (Pallas) J. & G.—Salmon-killer; Stickleback.

Extremely similar, but more robust, the body and head a little shorter and deeper. Caudal keel very strong. San Francisco to Alaska and Kamtschatka; very abundant northward.

(Gasteracanthus cataphractus Pallas, Mém. Acad. Petersb. iii, 325, 1811: Gasterosteus obolarius Cuv. & Val. iv, 500: Gasterosteus serratus Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 47: Gasterosteus intermedius Cirard, Proc. Ac. Nat. Sci. Phila. 1856, 135: Gasterosteus insculptus Rich. Last Arctic Voyage.)

#### 194.—APELTES DeKay.

(DeKay, New York Fauna, Fish. 1842, 67, nomen nudum: type Gasterosteus quadracus Mitch.)

Body moderately elongate, somewhat compressed, the back elevated at the beginning of the soft dorsal fin, thence declining in nearly a straight line to the tip of the snout. Tail very slender, not keeled. No bony dermal plates; the skin naked. Innominate bones not joined on the median line but separated, forming a bony ridge on each side of the abdomen, below which the strong ventral spines are depressible. Chest mostly bony; bare area in front of pectorals small, but distinct Gill-rakers rather short. Gill-membranes attached to the isthmus, without free edge. Free dorsal spines 3, strong, the first the longest, directed to one side; the next two directed toward the other side at different angles; attached spine of dorsal and anal well developed; a bony ridge on each side of the spinous dorsal. (a, privative;  $\pi \ell \lambda \tau \eta$ , shield.)

### 632. A. quadracus (Mitch.) Brevoort.

Brownish olive above, mottled with darker; silvery below; male almost black; ventrals with the membrane red in spring. Head 4 in length; depth 4. Caudal peduncle very long and slender, about 5 in length. D. III—I, 11; A. I, 8. L. 1½ to 2½ inches. Atlantic coast of the United States; very abundant northward.

(Gasterosteus quadracus Mitch. Trans. Lit. and Phil. Soc. i, 430, 1815: Gasterosteus apeltes Cuv. & Val. iv, 505; Gasterosteus quadracus Günther, i, 7.)

# ORDER T.—ACANTHOPTERI.

(The Spiny-rayed Fishes.)

Cranium normal, symmetrical; the maxillary bone distinct from the premaxillary, which forms the border of the mouth. Bones of the mandible distinct. Gills normal, laminated, rarely reticulated. Gill-openings in advance of the pectorals. Opercular apparatus complete. Basal bones of pectorals not enlarged. Pharyngeals well developed, the third superior pharyngeal usually largest. Lower pharyngeals separate or united. Ventral fits variously placed, often wanting, normally thoracic and six-rayed, the first ray spinous. Anterior rays of dorsal and anal normally developed as spines, but often soft and articulate. Air-bladder, if present, without pneumatic duct. The most extensive of the orders of fishes, comprising a great variety of forms. (αzανθα, spine; πτερον, fin.)

(Acanthopterygii, Pharyngognathi, and Anacanthini Giinther, i, ii, iii, iv, exclusive of various families. Orders Percesocus, Fercomorphi, and Pharyngognathi Cope, Trans. Amer. Phil. Soc. 1870, 456.)

#### ANALYSIS OF FAMILIES OF ACANTHOPTERI.

- A. Ventral fins abdominal; dorsals two, well separated. (Percesoces.)
- - C. Ventral region without sucking-disk.
    - D. Suborbital without bony stay.
      - E. Ventral fins present, the rays in normal number, \* I. 5.
        - F. Lower pharyngeal bones separate (except in certain Scianida); gills 4, a slit behind the last
          - G. Gill-membranes free from the isthmus.
            - Spinous dorsal transformed into a lamellated sucking-disk, situated on the top of the head.

ECHENEIDIDE, 70.

- HH. Spinous dorsal not transformed into a sneking-disk.
  - Scales small or obsolete, mostly cycloid; spinons dorsal comparatively little developed; candal peduncle slender,† the fin widely forked.† (Scombriform fishes.)
    - K. Vertebræ more than 24 or 25; no free anal spines.
      - L. Spinous dorsal represented by free spines; candal not forked; body clougate, fusiform.

ELACATIDE, 71.

<sup>\*</sup> Except in certain Stromatcide, Acanthuride, and Icostcide.

<sup>†</sup> Except in Pomatomidæ, Elacatidæ, and some Stromatcidæ.

LL. Spinous dorsal well developed, depressible in a groove - Seales minute or wanting: premaxillaries non-pro-.

tractile......Scombridge 74

- Scales of moderate size; premaxillaries protrac-

LLL. Spinous dorsal little developed, or not distinguishable from the soft parts; no finlets.

M. Œsophagus without tooth-like process. Coryphenide. 79. MM. Œsophagus with tooth-like process... Stromateide. 77. KK. Vertebræ 25 (24-26); two free anal spines (sometimes obsolete).

N. Scales minute or obsolete, cycloid; tail widely forked.

Carangidæ, 75.

NN. Scales small, weakly ctenoid; tail little forked.

Роматомира, 76. II. Scales well developed, mostly ctenoid; \* candal peduncle not especially slender.

O. Pectoral with the lower rays detached and filiform: two short, separated dorsal fins; head with muciferous system well developed.

POLYNEMIDÆ, 68.

OO. Pectoral fin entire.

P. Throat with two barbels; dorsals two; seales large. MULLIDÆ, 90.

PP. Throat without barbels.

Q. Skull cavernous; anal spines 1 or 2; lateral line extending on the candal fiu; head scaly; no teeth on vomer.

SCLENIDE, 91.

QQ. Skull not especially cavernous.

R. Anal fin comparatively short, with less than 13† soft rays; vomer mostly with teeth. (Perciform fishes.)

S. Scales caducous; dorsal fins two, the first short; month very oblique.

Apogonidæ, 89.

SS. Scales adherent.

T. Anal spines 1 or 2; dorsal fins 2; pseudobranchiæ small or obsolete.

Percidæ, 85.

TT. Anal spines 3; or more (rarely obsolete).

U. Pseudobranchiae small, covered by the skin, or obsolete,

V. Vomerine teeth; lateral line present. Elassomatidæ, 83 (b).

VV. Vomerine teeth none; lateral line obso-

lete ..... CENTRARCHIDE, 84. UU. Pseudobranchiæ well developed.

W. Maxillary not slipping under preorbital for its whole length.

<sup>\*</sup>Small or wanting in some Uranoscopida, Triehodontida, and Icosteida.

<sup>†</sup>Except in some Sparida, Priacanthida, Centrarchida, etc.

<sup>‡</sup> Obsolete in some Serranida; more than three in some Centrarchida.

t Mouth nearly vertical: ana! fin long: whole head closely scaly.

Priacanthidæ, 86 (b).

tt Mouth nearly horizontal: anal fin rather short .... Serranid E. SS.

WW. Maxillary with its upper edge for its whole length slipping under the preorbital ..... Sparadæ. 88.

RR. Anal fin elongate; pseudobranchiæ present; spinous dorsal little developed.

> X. Dorsal spines present: skeleton well ossified.

Y. Pectoral fins broad, procurrent for-

# Body scaly: slit behind fourth gill small; eves superior.

Uranoscopide, 103.

#Body naked: eyes lateral.

Trichopontidee, 102, YY. Pectoral fin narrow, not procur-

rent: body scaly. Latilide, 101 (b).

XX. Dorsal spines obsolete: skeleton more or less cartilaginous.

ICOSTEIDÆ, 101.

GG. Gill-membranes united to the isthmus, restricting the gill-openings to the sides.

> Z. Body not elevated; lateral line obsolete: spinous dorsal short and weak; inner rays of ventrals long-

> ZZ. Body elevated; lateral line present; spinous dorsal well developed (Chatodontiform fishes,)

a. Teeth setiform, in many rows; vertical fins densely scaly; tail nnarmed

b. Dorsal fin divided.

Ершериде, 97.

bb. Dorsal fin continuous.

CILETODONTIDE, 98. aa. Teeth incisor-like, in one row; tail with 1 or more spines on each side.

ACANTHURIDE, 99.

- FF. Lower pharyngeals united. (Pharyngognathi.)
  - c. Nasal openings single on each side; scales mostly ctenoid.
    - d. Gills 31, last slit small or obsolete; pseudobranchiæ present; anal spines 2.... Pomacentride, 96.
    - dd. Gills 4, a slit behind the last; pseudobranchiæ obsolete; anal spines 3 or more...CICHLIDE, 95.
  - cc. Nasal openings 2 on each side; anal spines 3; scales mostly cycloid. e. Viviparons; dorsal fin with a scaly sheath; anal rays slender and иниетоня ..... Емиютость.е, 93.
    - ec. Oviparous; anal rays rather few.

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f. Teeth villiform; premaxillaries extremely protractile; gills 4, a
                                         slit behind last: pseudobranchiæ
                                         concealed.......GERRID.E. 92.
         ff. Teeth not villiform; premaxillaries moderately protractile; gills
                                         31; last slit obsolete; pseudobran-
                                         chiæ well developed . Labrid.e. 94.
EE. Ventral fins, if present, with the rays in more or less than the normal
                                         number (I. 5).
    h. Anal fin present.
     i. Body compressed and elevated; the scales very small, or none.
       i. Dorsal spines indistinct.
         k. Ventral rays 4-6 ..... Bramide, 80.
         kk. Ventral rays about 15. . . . . . LAMPRIDIDE, 78.
       ij. Dorsal spines well developed; ventrals rays about I, 7. ZENID.E, 81.
     ii. Body not specially elevated.
           1. Ventrals thoracic (if present).
             m. Ventrals with more than 5 soft rays; scales etenoid; head
                                         armed
               n. Vent normal.....BERYCIDÆ, 82.
               nn. Vent in front of ventrals: dorsal spines few.
                                                    APHREDODERIDÆ, 83.
             mm. Ventrals few-rayed or wanting; scales small or wanting.
                 o. Upper jaw produced into a sword; dentition feeble;
                                         gills reticulated...XIPHIDE, 72.
                 oo. Upper jaw not produced; dentition very strong; body
                                         elongate.....TRICHIURIDÆ, 73.
           ll. Ventrals jugular (if present).
                   p. Pseudobranchiæ present. (Blenniiform fishes.)
                     q. Dorsal with many spines, sometimes entirely spinous.
                                                         BLENNIIDE, 113.
                     qq. Dorsal with few spines or none.
                       s. Gill-membranes united to the isthmus.
                                                          Zoarcide, 115.
                       ss. Gill-membranes broadly united, free from the
                                         isthmus: ventrals none.
                                                    Congrogadidæ, 116.
                       sss. Gill-membranes separate, free from the isthmus.
                         t. Ventrals filamentous, at the throat; jaws with
                                         teeth . . . . . OPHIDHDE, 118.
                         tt. Ventrals none; jaws toothless.
                                                       Ammodytidæ, 69.
                   pp. Pseudobranchiæ obsolete.
                           u. Dorsal without distinct spinous part.
                             v. Vent at the throat; ventrals none.
                                                     FIERASFERIDÆ, 117.
                             vv. Vent posterior.
                               w. Scales eycloid; caudal fin present.
                                                            Gadidæ, 120.
                               ww. Scales spinous, keeled; no candal fin;
                                         the tail attenuate.
                                                        MACRURIDE, 121.
                           uu. Dorsal fin with a distinct spinous part,
                                         composed of a few spines; ven-
                                         trals I, 2; gills 3, the gill-mem-
                                         branes broadly united to the
                                         1sthmus..... BATRACHIDÆ, 112.
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hh. Anal fin none: skeleton not ossified; eaudal rudimentary, or not in the line of axis of body.

TRACHYPTERIDÆ, 100.

DD. Suborbital with bony stay. (Cottiform fishes.)

r. Head not mailed.

r. Slit behind fourth gill large; body evenly scaled ......Chirde, 105.

xx. Slit behind fourth gill small or wanting. u. Gill-membranes separate, free from isthmus; ventral fins normally formed, mostly I, 5.

SCORPÆNIDÆ, 106.

un. Gill-membranes broadly joined, attached to the isthmus or not: ventral fins variously imperfect.

Соттіра, 107.

vv. Head mailed, externally bony.

z. Ventrals few-rayed, close together: last gill-slit obsolete.

AGONIDE, 107 (b).

zz. Ventrals 1, 4, or I, 5, usually wide apart: last gill-slit large.

Triglide, 108.

CC. Breast with a sucking-disk.

- a. Gill-openings narrow; spinous dorsal little developed; sucking-disk formed of the united ventral fins; pylorie eœea numerous; suborbital with a bony stay.
  - b. Skin smooth; vertebræ very numerous ..... Liparididæ, 109. bb. Skin tubercular; vertebræ rather few ..... CYCLOPTERIDÆ, 110.
- aa. Gill-openings wide; spinous dorsal wanting; sucking-disk between the ventral fins; no pyloric cœea; body naked...Gobiesocide, 111.

# FAMILY LXV.—MUGILIDÆ.

(The Mullets.)

Body oblong, more or less compressed, covered with rather large cycloid scales; no lateral line, but the furrows often deepened on the middle of each scale so as to form lateral streaks. Mouth small, terminal. Jaws with small teeth, or none; premaxillaries protractile. Gillopenings wide, the membranes separate, free from the isthmus. Branchiostegals 5 or 6. Gill-rakers long and slender. Gills 4, a slit behind fourth. Pseudobranchiæ large. Two short dorsal fins, well separated, the anterior with 4 stiff spines, the last one of which is much shorter than the others; second dorsal longer than the first, similar to anal;

Bull. Nat. Mus. No. 16-26

anal spines 3, rapidly graduated: ventral fins abdominal, not far back. attached to the elongate coracoid bone, composed of one spine and five rays: candal forked. Air-bladder large, simple. Intestinal canal long. Peritoneum usually black. Vertebræ 24. Genera 3; species 70-80; inhabiting the fresh waters and coasts of warm regions, feeding on organic matter contained in mud. A considerable indigestible portion of the latter is swallowed, and in order to prevent larger bodies from passing into the stomach, or substances from passing through the gill-openings, these fishes have the organs of the pharynx modified into a filtering apparatus. They take in a quantity of sand or mud, and after having worked it for some time between the pharyngeal bones, they eject the roughest and indigestible portion of it. The upper pharyngeals have a rather irregular form; they are slightly arched, the convexity being directed towards the pharvingeal cavity, tapering anteriorly, and broad posteriorly. They are coated with a thick, soft membrane, which reaches far beyond the margin of the bone, and is studded all over with minute horny cilia. Each branchial arch is proyided with a series of long gill-rakers, which are laterally bent downwards, each series closely fitting to the sides of the adjoining arch; they constitute together a sieve admirably adapted to permit a transit for the water, retaining at the same time every solid substance in the cavity of the pharynx. (Günther.)

The Mugilidæ, Atherinidæ, Sphyrænidæ, and Ophiocephalidæ compose the group or suborder of Percesoces, thus characterized. Ventral fins abdominal; branchial arches well developed, the bones all present except the fourth superior branchihyal. Third superior pharyngeal much enlarged; lower pharyngeal distinct. Scales cycloid. Pectorals elevated, about on a level with the upper posterior angle of operculum; spinous dorsal usually present. (Latin, Perca, a perch; Esox, a pike—the group being intermediate in its position between the Percoids and the Haplomi.)

(Mugilida Günther, iii, 409, 467.)

#### 195.-MUGIL Linnaus.

(Mullets.)

(Artedi; Linnæus, Syst. Nat.: type Mugil cephalus L.)

Body oblong, somewhat compressed, covered with large cycloid scales. Head large, bluntish, convex above, scaled. Mouth small. Jaws tooth-

less, usually provided with short, flexible cilia resembling teeth; lower jaw forming an angle at the symphysis. A portion of the stomach modified to form a muscular gizzard. Species very numerous, found in great schools near the shore in all warm regions. (Latin Mugil, the ancient name, from mulaco, to suck.)

\* Adipose eyelid well developed.

a. Scales medium (40-42 series); sides with dark stripes; anal rays III, 8.

### 633. M. mexicamus Steindachner.—California Mullet; Macho.

General form, coloration, and appearance of *M. albula*, the head rather longer, broader, and more depressed; interorbital space about half length of head. Anterior rays of dorsal and anal with small scales, the posterior part of the fin naked. Eye rather small; the adipose eyelid very thick. Bluish above; sides silvery, with dark stripes along the rows of scales. Head 4; depth 4. D. IV-I, 8; A. III, 8; Lat. l. 42. Pacific coast, chiefly south of Point Concepcion; abundant; very close to the next, of which it is probably a variety.

(Steindachner, Ichth. Beiträge, iii, 58, 1875.)

#### 634. M. albala L.-Striped Mullet.

Body rather elongate, little compressed, subterete. Snout not broad, moderately depressed. Mouth moderate, the lips thin, the maxillary not nearly covered by the preorbital; angle made by the dentary bones obtuse, or nearly a right angle. Space at the chin between the mandibulary bones oblanceolate, acutish anteriorly. Scales comparatively small, a few on the dorsal and anal fins. Pectoral fins placed little above the axis of the body. Coloration dark-bluish above; sides silvery, with conspicuous darker lateral stripes; a dusky blotch at base of pectorals. Head 4\frac{1}{3}; depth 4. D. IV-I, 8; A. III, 8; scales 42-13. Atlantic coast of United States; very abundant southward, where it is much valued as a food-fish.

(Linn, Syst. Nat.: Magil plumieri Bloch, Ansl. Fisch, taf. 393: Magil lineatus Cuv. & Val. xi, 93: Magil lineatus Gthr. iii, 417: Magil berlandieri Grd. U. S. Mex. Bound. Surv. 20, fig. 1—fig. 4 represents the young of M. brasilieusis.)

aa. Scales larger (33 series); sides without conspicuous dark stripes; anal rays III.9.

### 635. M. brasiliensis Ag.-White Mullet; Liza.

Body oblong, rather compressed. Snout moderate. Mouth moderate; the maxillary mostly concealed under the preorbital; angle made by the dentaries about a right angle. Space at the chin between the mandibularies somewhat club-shaped. Scales comparatively large; soft

dorsal\* and anal fins covered with small scales; pectoral fins mostly naked, inserted high. Coloration bluish above; the sides silvery, without conspicuous dark stripes, but with shining streaks along the rows of scales; a dusky blotch at the base of the pectoral; tips of caudal and soft dorsal blackish. Head 4; depth 4. D. IV-I, 8; A. III, 9; scales 38-12; vert. 11+13. Cape Cod to South America, and Lower California; abundant; on our Atlantic coast, usually reaching a smaller size than Mugil albula.

(Agassiz Spix. Pisc. Brazil, 234: Mugil eurema and Mugil petrosus Cuv. & Val. xi, 87, 89; Günther, iii, 431: Mugil lineatus Storer, Hist. Fish. Mass.)

# FAMILY LXVI.—ATHERINIDÆ.

(The Silversides.)

Body rather elongate, somewhat compressed, covered with cycloid scales of moderate or small size. No lateral line; some scales often with rudimentary mucous tubes. Cleft of the mouth moderate. Teeth small, on jaws and sometimes on vomer and palatines, rarely wanting. Premaxillaries protractile or not. Opercular bones without spines or serrature. Gill-openings wide, the gill-membranes not connected, free from the isthmus. Gills 4, a slit behind the fourth. Pseudobranchiæ present. Gill-rakers usually long and slender. Branchiostegals 5 or 6. Dorsal fins 2, well separated, the first of 3-8 feeble, flexible spines, the second of soft rays. Anal with a weak spine, similar to the soft dorsal, but usually larger. Ventral fins small, abdominal, not far back, of 1 small spine and 5 soft rays. Pectorals moderate, inserted high. Airbladder present. No pyloric cœca. Caudal and abdominal vertebræ very numerous. Carnivorous fishes, mostly of small size, living in great schools near the shore in temperate and tropical seas; a few species in fresh water; nearly all the species have a silvery band along the side. Genera about 8; species 50.

(Atherinida pt. Günther, iii, 391-407.)

- a. Premaxillaries freely protractile (their skin not continuous with that of the forehead),
  - b. Premaxillary narrow, its edge nearly straight; teeth on vomer. Atherina, 193. bb. Premaxillary broad posteriorly, its edge curved; no teeth on vomer.
    - c. Teeth none.....Leurestnes, 197.

<sup>\*</sup>Dorsal and anal partly naked, pectoral wholly so in specimens from North Carolina; dorsal and anal densely scaly, pectoral mostly scaly in specimens from Acapulco, Mex., otherwise similar.

- cc. Teeth in bands.
- aa. Premaxillaries not truly protractile (skin of the premaxillaries mesially continuons with that of the forehead).

### 196.-ATHERINA Linnieus.

#### Friars.

(Linnæus, Syst. Nat. xii, 1766: type Atherina hepsetus L.)

Body oblong, compressed. Mouth large, terminal, oblique; jaws about equal, their edges nearly straight; maxillary extending to the front of the eye. Premaxillaries narrow posteriorly, anteriorly protraetile. Villiform teeth in bands on jaws, vomer, and palatines. Species numerous, mostly European.  $(a\theta z \rho i \gamma_1)$ , the ancient name, from  $a\theta \dot{r}_i \rho$ , a barb or spike, from the form of body or the numerous bones; possibly from  $\partial \theta \epsilon \rho i \zeta \epsilon i \nu$ , to despise, from their diminutive size.)

#### 636. A. carolina Cuy, & Val.

Very similar to the European A. hepsetus, but with the head smaller and the body slenderer. Depth 63 in total length, with caudal. D. VIII-I, 12; A. I, 15. L. 4 inches. South Carolina; not seen by recent writers. (Cuv. & Val.)

(Cuv. & Val. x, 445, 1835.)

### 637. A. veliana Goode & Bean.

Shout obtuse, top of head broad and very flat; eleft of mouth somewhat oblique; jaws equal anteriorly; maxillary extending beyond front of orbit. Teeth very small in the jaws and on the vomer. The silvery band occupies the third row of scales, its width less than half the diameter of the eye. Diameter of orbit contained twice in length of head. greater than interorbital width and more than twice the length of the snout. Spinous dorsal beginning behind the vertical from the tips of the ventral fins. Head 33 in length; depth 4\frac{2}{3}. D. V-I, 9; A. I, 10; Lat. 1. 36; L. transv. 63. (Goode & Bean.) Clear Water Harbor, Florida. (Goode & Bean, Proc. U. S. Nat. Mus. ii, 342, 1879.)

#### 197 .- LEURESTHES Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 29: type Atherinopsis tenuis Avres.)

This genus agrees with Menidia in every respect, except that the teeth are obsolete. But one species is certainly known. (λευρος, smooth; ἐσθίω, to eat.)

#### 638. L. temuis (Avres) J. & G.

Clear hyaline green, with the lateral silvery streak very distinct, wider than eye, on 1½ rows of scales; edges of scales above bordered by dark points. Scales small, smooth, and firm, closely imbricated, their edges erenate. Maxillary not reaching to pupil. Premaxillary very protractile, curved, its posterior portion broad. Lower jaw shorter than upper. First dorsal fin over front of anal, much nearer base of candal than snout. Eye equal to snout. Head  $4\frac{1}{2}$ ; depth 5. D. V-I, 9; A. I, 22; Lat. 1.75. L. 5 inches. Coast of California; abundant in San Diego Bay.

(Atherinopsis tenuis Ayres, Proc. Cal. Acad. Nat. Sci. 1830, 76.)

### 198.—LABIDESTHES Cope.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 455: type Chirostoma sicculum Cope.)

This genus differs from *Menidia* chiefly in the prolongation of the jaws, both of which are produced into a short depressed beak. ( $\lambda \tilde{a}_i \hat{\tau} \hat{\iota}_5$ , a pair of forceps;  $\hat{\epsilon} \hat{\sigma} \theta \hat{\iota} \omega$ , to eat.)

### 639. L. sievulus Cope.—Brook Silverside; Skipjack.

Pale olive-green, translucent; lateral silvery band very distinct, scarcely broader than pupil, bounded above by a dark line; back dotted with black. Body elongate, very slender, compressed. Head long, flattish above, narrow below. Snout slender, conic. Premaxillaries broad posteriorly, very protractile, produced forwards, the snout longer than the large eye. Edge of upper jaw strongly concave. Teeth very slender, mostly in one series, forming a narrow band in front. Scales small, thin, with entire edges. Spinous dorsal very small; soft dorsal short. Anal fin long; caudal forked; pectorals moderate. First dorsal inserted somewhat behind the vent. Head 4½; depth 6; eye 3½ in head. D. IV-I, 11; A. I, 23; Lat. l. 75. L. 3½ inches. Ponds and sluggish streams; Michigan to lowa and Tennessee; locally abundant; a very graceful little fish.

(Chirostoma sicculum Cope, Proc. Acad. Nat. Sci. Phila. 1865, 81: Labidesthes sicculus Cope, Proc. Amer. Phil. Soc. Phila. 1870, 49.)

## 199.-MENIDIA\* Bonaparte.

#### Silversides.

(Argyrea DeKay: Basiliehthys Grd.: Labidesthes Cope.)

(Bonaparte, Fauna Italica, about 1849: type Atherina menidia L.)

Body elongate, more or less compressed. Head oblong, compressed. Month small, the gape curved, very oblique, usually not reaching the eye;

<sup>\*</sup>Chirostoma Swainson, Classin. Fishes, etc. 1839, 243 (= Atherinoides Bleeker = Atherinoichthys Bleeker = Heterognathus Grd., all these nominal genera based on the same type, Atherina humboldtiana Cuv. & Val., from Mexico), is distinguished from Menidia by the very long and strong mandible which protrudes beyond the upper jaw. There are a few vomerine teeth, and the premaxillary is extremely protractile.

lower jaw short; maxillary slipping entirely under prorbital; jaws each with a band of simple, usually villiform teeth. Premaxillaries very freely protractile\*, their spines comparatively long, nearly equal to the eye, extending backward beneath a fold of skin which connects the bases of the maxillaries; posterior part of premaxillaries broad. No teeth on vomer or palatines. Scales entire, or with the edges crenate or laciniate. Species numerous, of moderate or small size, some of them entering fresh waters. (Menidia, an old name of some small silvery fish, from \$\mu\_{\textstyle \chi\_{\textstyle \chi\_{\textstyl

#### 610. 31. bosci (C. & V.) J. & G.

Clear transparent green; sides with a well-defined silvery band, \( \frac{2}{3} \) diameter of the eye; back and chin with large, black dots. Eye large, \( 3\)\frac{1}{3} in head, a little longer than snout. Scales firm, their edges strongly crenate, those on the back laciniate. Upper jaw the longer. First dorsal very feeble, over the beginning of the anal, rather nearer the tip of the caudal than the snout. Distance from first to second dorsal \( \frac{2}{3} \) length of head. Pectorals reaching ventrals, nearly as long as the head. Ventrals falling far short of the base of the first dorsal; second dorsal very short. Teeth short, even, forming a narrow villiform band. Head \( 4\)\

(Atherina menidia Linn. Syst. Nat.: Atherina bosei Cuv. et Val. x, 465, 1835: Atherina menidia DeKay, New York Fauna, Fish. 142: Atherinichthys menidia et notata Günther, iii, 405.)

#### 641. M. vagrams (Goode & Bean) J. & G.

Silvery streak occupying the lower two-thirds of the third and the upper two-thirds of the fourth series of scales. Eye 3 in head, as long as lower jaw, greater than snout and less than interorbital width. Premaxillaries freely protractile; teeth rather strong. Scales laciniate on the back, nearly entire laterally. First dorsal inserted opposite the space between the anal fin and the vent, nearer base of candal than snout. Pectoral about as long as head. Candal slightly forked, the lobes equal. Vertical fins excessively scaly. Head 5; depth 5\frac{3}{4} D. V-1, 7; A. I, 18; scales 48-7. L. 4 inches. Virginia to Gulf of Mexico. (Chirostoma ragrans Goode & Bean, Proc. U.S. Nat. Mus. 1879, 148.)

### 642. M. notata (Mitch.) J. & G.—Silverside.

Transparent green, with a lateral silvery band half the width of the

<sup>\*</sup>We have been able to verify this character on only a few of the foreign species. We are therefore uncertain whether the bulk of the species referred by Dr. Günther to "Atherinichthys" belong to Menidia or to Atherinopsis.

eye; scales above with spots along their edges, so that their outlines are clearly defined; chin speckled. Scales with entire edges. Eye large, 3½ in head, about as long as the snout. Jaws equal. First dorsal larger than in *M. bosci*, inserted in front of the anal, over the vent, about midway between snout and base of caudal. Distance between dorsals  $\frac{2}{3}$  length of head. Pectoral scarcely shorter than head, reaching past base of ventrals, which do not reach the vent or the front of the dorsal. Body slenderer, and more compressed than in *M. bosci*. Teeth in few series, some of them larger. Head 5; depth 6. D. IV-I, 8; A. I, 23; scales 46–10. L. 5 inches. Atlantic coast of United States, chiefly northward; abundant.

(Atherina notata Mitchill, Trans. Lit. and Phil. Soc. N. Y. 1814, 446: Atherina notata Dekay, New York Fauna, Fish. 141: Atherina menidia Cuv. et Val. x, 462: Chirostoma notatam of most recent writers.)

# 643. M. beryllina (Cope) J. & G.

Pale olive, with a silver band on  $2\frac{1}{2}$  rows of scales. Body stouter than usual. First dorsal far in advance of second, inserted over the vent, slightly nearer base of caudal than snout. Eye large, 3 in head. Mandible slightly projecting. Scales not described. Head  $4\frac{1}{4}$ ; depth 6. D. V-I, 11; A. I, 18. L.  $2\frac{1}{2}$  inches. Potomac River. (Cope.)

(Chirostoma beryllinum Cope, Trans. Am. Phil. Soc. 1866, 403.)

# 644. M. brasiliensis (Quoy & Gaimard) J. & G.

Olivaceous, the silvery lateral stripe less than half the diameter of the eye; scales on back covered with dark dots. Scales all entire. Cleft of mouth reaching to nearly opposite eye. Jaws equal. Teeth not forming a close band. First dorsal inserted over the front of the anal, nearer the base of the caudal than the snout. Pectoral as long as the head, reaching well past root of ventrals, which reach the vent. Eye 3\frac{1}{3} in head. Head 4; depth 5. D. IV-I, 9; A. I, 21; scales 40-8. L. 3 inches. Florida to Mexico and Brazil. Described from a specimen obtained in Saint John's River, Florida.

(? Atherina brasiliensis Quoy & Gaimard, Voy. Uran. Poiss, 332: Atherina brasiliensis Cuv. & Val. x, 467: Atherinichthys brasiliensis Günther, iii, 404.)

#### 645. M. peminsulæ (Goode & Bean) J. & G.

Silvery streak occupying the fourth and upper half of the fifth row of scales. Eye 3 to 3½ in head, about equal to the snout and the interorbital width. Mouth very protractile; lower jaw long, more than one-third the length of the head. Scales not described. First dorsal fin far in advance of the anal fin, in front of the vent, about midway between base of candal and snout. Candal deeply forked, its lobes equal. Head 4; depth 5. D. V-I, 8; A. I, 15; scales 38-9. L. 4 inches. Florida. (Goode & Bean.)

(Chirostoma peninsula Goode & Bean, Proc. U. S. Nat. Mus. 1879, 148.)

#### 200.—ATHERINOPSIS Girard.

# Pescadillo del Rey.

(Girard, Proc. Acad. Nat. Sci. Phila, 1854, 134: type Atherinopsis californicasis Grd.)

This genus differs from *Menidia* in the non-protractility of the upper jaw. The spines of the premaxillaries are very short, much shorter than the eye, and they are covered by a skin which is continuous with that of the torehead, being only capable of such motion as is permitted by the extension of a fold of skin between the jaws and the frontal region. Species reaching a considerable size and having importance as food-fishes. ( $\alpha\theta z \rho z \sigma z$ , Atherina;  $\alpha \psi z_5$ , appearance.)

#### 6.26. A. collifornia Pasis Girard. - California Smelt.

Translucent greenish, a burnished lateral stripe which is rather plumbeous than silvery, some yellow on the opercles. Body clongate, little compressed. Maxillary narrow, not reaching to the eye, not slipping under the preorbital. Jaws even; teeth small, pointed, in narrow bands; inner series of upper jaw enlarged. Gill-rakers very long and slender. Scales crenate, somewhat rough, but not laciniate. First dorsal large, inserted in front of anal nearer base than snout; second dorsal inserted in front of middleof anal, which has a scaly sheath. Pectorals nearly as long as head, not reaching to ventrals, the latter half way to vent. Eye small, 5 in head. Head  $4\frac{a}{4}$ ; depth 5. D. IX-I, 12; A. I, 23; scales 77-13. L. 18 inches. Pacific coast of United States; very abundant; a food-fish of considerable importance.

(Girard, Proc. Acad. Nat. Sci. Phila, 1854, 134; Girard, U. S. Pac. R. R. Surv. Fish. x, 103: Atherinichtlys californiensis Giinther, iii, 405.)

### 201.—ATHERINOPS Steindachner.

(Steindachner, Ichth. Beiträge, iii, 61, 1875: type Atherinopsis affinis Ayres.)

Teeth bifid, arranged in a single row in each jaw. Otherwise as in Atherinopsis. One species known. ( $\alpha\theta\varepsilon\rho\nu\sigma_{t}$ , Atherina;  $\omega\phi$ , appearance.)

#### 647. A. affinis (Ayres) Steindachner.—Little Smelt.

Clear hyaline green, a silvery lateral band, 1½ scales wide, narrower than eye, bordered above by a purplish line. Back and sides thickly punctate. Iris and opercles with bright yellow. Maxillary not reaching

papil. Lower jaw slightly shorter than upper. Teeth close-set, incisor-like, Y-shaped, the forks divergent; those in lower jaw largest and most movable. Eye large, not longer than snout. Spinous dorsal moderate, inserted over the vent, its origin midway between posterior angle of opercle and base of caudal. Peetoral about as long as the head, reaching ventrals, the ventrals not to vent. Body stouter than in related species. Scales firm, crenate. Peritoneum dark. Head 5; depth 4½. D. VI-I, 11; A. I, 22; Lat. 1, 54. L. a foot. Pacific coast of United States, with Atherinopsis californiensis, and equally abundant.

(Atherinopsis affinis Ayres, Proc. Cal. Acad. Nat. Sci. 1850, 73.)

# FAMILY LXVII —SPHYRÆNIDÆ.

(The Barracudas.)

Body elongate, subterete, covered with small cycloid scales. Head very long, pointed, pike-like, scaly above and on sides. Mouth horizontal, large. Jaws elongate, the lower considerably projecting; upper jaw non-protractile, its border formed by the premaxillaries, behind which are the broad maxillaries. Large, sharp teeth of unequal size on both jaws and on palatines; none on the vomer; usually a very strong tooth near the tip of the lower jaw. Opercular bones without spines or serratures. Gill-openings wide, the gill-membranes not united, free from the isthmus; gill-rakers very short or obsolete. Branchiostegals 7; gills 4, a slit behind the fourth. Psuedobranchiæ well developed. Air-bladder large, bifurcate anteriorly; many pyloric cœca. line well developed, straight. Pectoral fins short, placed in or below the line of the axis of the body; ventrals I, 5, abdominal, in advance of the middle of the body; first dorsal over ventrals, of 5 rather stout spines; second dorsal remote from first dorsal, similar to anal and opposite to it; caudal fin forked. Vertebræ 24. A single genus of about 15 species; voracious pike-like fishes, inhabiting nearly all temperate and tropical seas.

(Sphyranida Günther, ii, 334-341.)

#### 202.—SPHYRÆNA Bloch.

#### Barracudas.

(Artedi; Bloch, Ichth.: type Esox sphyrana Gmel.)

Characters of the genus included above. (σφύραινα, the ancient name, "hammer fish," from σφῦρά, a dart.)

<sup>\*</sup> Pectorals not reaching nearly to front of dorsal.

#### 648. S. argenten Grd.-Barracuda.

Brownish, with bluish lustre; belly white, scarcely silvery. Body elongate, little compressed. Lower jaw much produced, fleshy at tip. Eye 10 in head. Maxillary not reaching front of eye; about 3 in head. Teeth moderate, little compressed. Spinous dorsal inserted a little nearer snout than caudal, just in front of ventrals, well behind the end of the pectorals, which are a little longer than the ventrals and less than one-tenth the total length. Scales very small. Head 3\frac{3}{4}; depth 7\frac{1}{2}. D. V-I, 9; A. I, 8; scales in 238 series, 166 in the lateral line. L. 3 feet. Pacific coast, from San Francisco southward; abundant; an important food-fish.

(Girard, Proc. Acad. Nat. Sci. Phila, 1854, 144; Steindachner, 1chth. Beitr. vii, 1; Günther, ii, 338.)

# 619. S. spet (Haiiy) Lacépède.—Barracada.

Olivaceous, silvery below; young with dusky blotches across the back and along the lateral line. Body rather slender, with rather large scales. Maxillary not reaching eye;  $2\frac{1}{2}$  in head. Teeth moderate. First dorsal inserted slightly in front of base of ventrals, nearly midway between snout and base of caudal, much behind the end of the pectorals. Space between dorsals about one-sixth of the total length. Pectorals about as long as ventrals, 12 in total length. Eye 8 in head. Lower jaw with a fleshy tip. Head 3; depth 8. D. V-I, 9; A. I, 9; Lat. 1. 130-150. L. 24 inches. Cape Cod to the Mediterranean (the common European species); not rare on our coast.

(Esox spet Haiiy, Encyclop. Method. Poiss, iii, 7187; Sphyrana vulgaris Giinther, ii, 334; Esox sphyrana Ginel. Syst. Nat. 1389; Lacépède, Hist. Nat. Poiss, v, 326; ?Sphyrana borcalis DeKay, New York Fauna, Fish. 39; Sphyrana borcalis Goode & Bean, Proc. U. S. Nat. Mus. 1879, 146. More than one species has been confounded under the above names.)

# 650. S. guaguancho Cuv. & Val.

Origin of first dorsal fin in front of the middle of the body, more or less in advance of the tip of the pectorals. Ventrals in front of the dorsal. Fifth dorsal spine midway between tip of snout and base of caudal. Pectoral as long as postorbital part of head. Interspace between dorsals 5½ in length. Eye 6 in head. Opercle with 2 points. Head 3¼; depth 7. D. V-1,9; A. II, 8; scales 14-110-17. L. 18 inches. Cape Cod to Florida and Cuba. (Goode & Bean.)

(Cuv. & Val. iii, 342; Goode & Bean, Proc. U. S. Nat. Mus. 1879, 146; Sphyrana gnagnanche Pocy, Memorias, ii, 166.)

<sup>\*\*</sup> Pectoral reaching front of spinous dorsal.

### 651. S. picuda Bloch & Schneider .- Picuda: Barracuda.

Origin of first dorsal opposite ventrals, far in advance of the middle of the body, at the tip of the pectorals. Interspace between dorsals one-fifth of total length. Pectoral fins one-eleventh of total length. Scales large. Head  $3\frac{1}{2}$  in total length; depth  $7\frac{1}{4}$ . D. V-I, 9; A. I, 9; scales 9-83-15. Vertebræ 12+12. L.  $3\frac{1}{2}$  feet. (Günther.) West Indies, north to Florida.

(Bloch & Schneider, 1801, 110: Sphyrana barracuda Cnv. & Val. iii, 343; Günther, ii, 335; Goode & Beau, Proc. U. S. Nat. Mus. 1879, 146.)

# FAMILY LXVIII.—POLYNEMIDÆ.

(The Thread-fins.)

Body oblong, compressed, covered with rather large scales, which are feebly ciliated or smooth; lateral line continuous, extending on the caudal fin. Head entirely scaly; snout conic, projecting over the horizontal mouth, which is rather large, the maxillary extending to beyond the eve. Eye lateral, anterior, large, with a large adipose eyelid. Villiform teeth on jaws and palatines and usually on vomer also. Pseudobranchiæ concealed. Branchiostegals 7. Gill-membranes separate, free from isth-Gills 4, a slit behind fourth. Dorsal fins 2, well separated, as in the Percesoces, the first of about 7 feeble but rather high spines, the second rather larger, of soft rays. Anal fin similar to the soft dorsal, sometimes larger; caudal fin widely forked; second dorsal, anal, and caudal fins usually covered with small scales; ventrals I, 5, thoracic, but placed well behind the pectorals; pectoral fins moderate, placed low, divided into two parts, the lower and anterior portion composed of several filiform articulated appendages, free from each other, organs of touch. Bones of skull with a well-developed muciferous system, as in Sciwnida. Basis eranii donble, with tube; post-temporal bifurcate; scapula with median foramen; superior pharyngeal bones 4, third largest, narrow, directed forward. Basal pectoral bones divided; two normal, supporting the fin, one longitudinal without rays, and one a plate on the coracoid, supporting elongate rays. Stomach eccal, with a few pyloric appendages. Air-bladder various, sometimes wanting. Vertebræ 24. Genera 3; species 25. Tropical seas. A singular group, in some respects intermediate between Scianida and Mugilida, but not closely related to any other of our fishes. Most of them are valued as food fishes.

(Polynemidæ Günther, ii, 319-333.)

### 203.—POLYNEMUS Linnaus.

(Trickidion Klein: Gill.)

(Linn. Syst. Nat.: type Polynemus paradisaus Linn.)

Teeth in villiform bands on both jaws, vomer, palatines, and pterygoids. Preopercle sharply serrated on its posterior margin, its angle with a scaly flap. Scales rather small, finely etenoid. First dorsal with 7 or 8 feeble, rather high spines, the first and last short. Soft dorsal and anal fins about equal to each other; pectoral filaments 3 to 9. Pyloric execa in great number. Species numerous in warm seas.  $(\pi o \lambda v \tau, \max; \nu \tilde{\eta} \mu a, \text{thread}; \text{ from the numerous pectoral appendages.})$ 

### \* Pectoral appendages 7.

# 649. P. plumieri (Lac.) Gthr.

Silvery; pectoral fins black. Maxillary extending backwards past eye to base of mandible. Pectoral filaments about as long as the fin. Spinous dorsal high; soft dorsal similar to anal, its last ray produced. Head  $3\frac{1}{2}$  in length; depth about  $3\frac{1}{2}$ . D. VII-I, 12; A. II, 13; scales 6-58-10. West Indies; occasional on our South Atlantic coast.

(Polydactylus plumicri Lac. v, pl. 14, f. 3; Günther, ii, 321: Trichidion plumicri Gill, Proc. Ac. Nat. Sci. Phila. 1861, 279.)

# 650. P. octofilis (Gill) J. & G.

Silvery, vertical fins punctulated with black; pectoral fins black. Pectoral filaments short, reaching middle of interspace between dorsal fins. Maxillary  $2\frac{9}{3}$  in length of head. Eyes large, about 4 in head. Head  $3\frac{1}{2}$  in length; depth about  $3\frac{1}{3}$ . D. VIII-I, 11; A. II, 14; scales 6-60-10. New York; one specimen known.

(Trichidion octofilis Gill, Proc. Acad. Nat. Sci. Phila. 1861, 280.)

#### 651. P. octonemus Grd.

Brownish, sides silvery; fins white. Pectoral filaments very long, the longest reaching past the front of the anal fin. Eye 4 in head. Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ . D. VIII-I, 12; A. II, 13; scales 6-61-10. (Girard.) Florida to Texas.

(Girard, Proc. Acad. Nat. Sci. Phila. 1858, 167; Günther, ii, 320: Trichidion octonemus Gill, Proc. Acad. Nat. Sci. Phila. 1861, 286.)

<sup>\*\*</sup> Pectoral appendages 8.

# FAMILY LXIX.—AMMODYTIDÆ.

### The Sand Launces.

Body elongate, compressed, covered with small cycloid scales. Head long. Mouth rather large, nearly horizontal, the lower jaw considerably projecting, the symphysis produced. No teeth in jaws. openings very wide; gill-membranes not united, free from the isthmus. Branchiostegals 6 to 8. Pseudobranchiæ large, lamellate. Gill-rakers long and slender; gills 4, a slit behind the fourth. Opercles well developed, without spines or serratures. Eve moderate. Premaxillaries very protractile. Maxillaries long and slender. Lateral line running along side of back. Spinous dorsal absent (or represented by a few weak spines); soft dorsal very long and low, fragile, extending from behind the head to near the base of caudal. Caudal fin small, forked. Anal similar to dorsal, but smaller. Vent somewhat behind middle of body. No ventral fins. Pectoral fins inserted low. No air-bladder. Pyloric cœca usually 1. Genera 4, species 8. Small fishes swimming in large schools and often burying themselves in the sand. Found along the coasts of northern regions.

(Ophidiidæ group Ammodytina Giinther, iv, 384-388.)

- \* Body with many transverse, oblique folds; a longitudinal fold of skin along sides of belly; vomer unarmed.

### 201.—AMMODYTES Linnæus.

#### Sand Launces.

(Artedi; Linn. Syst. Nat.: type Ammodytes tobianus L.)

Body elongate, lanceolate, the skin with many transverse folds running obliquely downward and backward, the small cycloid scales mostly placed in cross-series between them. Lateral line concurrent with the back. A fold of the skin along each side of the belly. Vomer not armed with a bicuspid tooth. Color silvery. Vertebræ 63. (ἀμμως, sand; δόω, to dive.)

### 652. A. americanus DeKay.—Sand Launce; Sand Eel; Lant.

Olivaceous above, silvery below; sides with a steel-blue stripe. Pectoral fins much longer than snout, reaching front of dorsal. Lateral folds 125-130. Depth equal to length of mandible, which is 2\frac{1}{3} in head.

Head  $4_4^3$ ; depth about 10. D. 60; A. 28. Newfoundland to Cape Hatteras, abundant. Scarcely different from A. tobianus of Europe.

(DeKay, New York Fauna, Fish. 1842, 317; Günther, iv, 356; Storer, Hist. Fish. Mass.)

#### 653. A. personatus Grd.—Sand Launce.

Clear hyaline green; sides silvery. Pectoral fin half length of head, reaching past the front of the dorsal. Lateral folds 130–150. Head 4½; depth 9. Eye 2 in snout, 6 in head. D. 54; A. 24. L. 6 inches. Monterey to Alaska, very abundant; probably also a variety of A. tobianus.

(Girard, Proc. Ac. Nat. Sci. Phila, 1856, 137; Günther, iv, 387.)

### 654. A. alascanus Cope.

Dorsal inserted above middle of pectoral. Maxillary reaching front of orbit. Mandible less than depth of body. Head 4½; depth 9. Eye 2 in snout, 6 in head. Lateral folds 182. D. 62; A. 31. L. 6 inches. Sitka, Alaska. (Cope.)

(Cope, Proc. Am. Phil. Soc. 1873. Probably also a form of A. tobianus.)

#### 655. A. dubius Reinh.

Skin with about 150 very distinct folds. Dorsal fin inserted over posterior third of pectoral. Head 6; depth equalling length of mandible,  $2\frac{1}{3}$  in length of head. D. 65; A. 34. Cape Cod to Greenland. (Günther.)

(Reinhardt, Dansk. Vidensk. Selsk. Afhandl. 1838, 132; Günther, iv, 387.)

#### 205.—ARGYROTÆNIA Gill.

(Gill, Cat. Fish. East Coast N. Amer. 1861, 40 (not characterized): type Ammodytes vittatus DeKay.)

This genus is supposed to differ from *Ammodytes* in the presence of a rudimentary spinous dorsal, composed of about 7 minute free spines. (αργορος, silver; ταινία, ribbon.)

### 656. A. vittata (DeKay) Gill.

Greenish olive above, with a broad silvery band along the sides, which is margined above with blackish; silvery below. Body oblong, somewhat compressed, slender. Head small and pointed, flattened and grooved above, compressed beneath. Eyes large. Snout terminating in a bifid tip. Mouth rather large, protractile, toothless. Lower jaw longest. D. VII, 54; A. 28. Sag Harbor, New York. (DeKay.) It has not been seen since its description by DeKay, and its existence is extremely doubtful.

(Ammodytes vittatus DeKay, New York Fanna, Fish. 1842, 3!8.)

# FAMILY LXX.—ECHENEIDIDÆ.

(The Remoras.)

Body fusiform, elongate, covered with minute, eycloid scales. Mouth wide, with villiform teeth on jaws, vomer, palatines, and usually on tongue. Premaxillaries not protractile. Lower jaw projecting beyond Spinous dorsal modified into a sucking-disk, which is placed on the top of the head and neck, and is composed of a double series of transverse, movable, cartilaginous plates, serrated on their posterior or free edges. By means of this disk these fishes attach themselves to other fishes or to floating objects, and are carried for great distances in the sea. Opercles unarmed. Pectoral fins placed high; ventral fins present, thoracic, and close together—I, 5; dorsal and anal fins long, without spines, opposite each other; caudal fin emarginate or rounded. Branchiostegals 7. Gills 4, a slit behind the fourth; gill-rakers short; gill-membranes not united, free from the isthmus. Pseudobranchiæ ob-Several pyloric appendages. No air-bladder. No finlets. No caudal keel. Vertebræ more than 10 + 14. Genera 2; species about 10, found in all seas, all having a very wide range.

(Scombridae part: genus Echeneis Günther, ii, 376-385.)

#### 206.-ECHENEIS Linnaus.

(Artedi; Linn. Syst. Nat.: type Echeneis naucrates L.)

Pectoral rays soft and flexible. Characters otherwise included above. ( $\frac{1}{2}\chi = \nu \hat{\eta} + \varepsilon$ , an ancient name, from  $\frac{1}{2}\chi \omega$ , to hold back;  $\nu \alpha \upsilon \varepsilon$ , a ship.)

a. Body very slender; vertebræ 14+16. (Echeneis.)

#### 657. E. naucrates L.-Pegador.

Brownish; belly dark like the back, as usual in this family; sides with a broad stripe of darker edged with whitish, extending through eye to snout; caudal black, its outer angles whitish; pectorals and ventrals black, sometimes bordered with pale; dorsal and anal broadly edged with white anteriorly. Body elongate, subterete, slender. Disk long. Dorsal and anal fins longer than the disk; inner rays of ventral fins narrowly adnate to the abdomen; caudal becoming emarginate with age. Vertebræ 14+16. Vertical fins low; pectorals \( \frac{3}{4} \) length of head, rather long and acute. Lower jaw projecting, with the tip flexible.

Maxillary barely reaching vertical from nostril. Head  $5\frac{1}{2}$  in length; disk  $3\frac{2}{3}$ ; width between pectorals about  $7\frac{1}{2}$ . D. XXI-XXV—32-41; A. 34 (32-38). In all warm seas, north to Cape Cod and San Francisco.

(Linn. Syst. Nat.; Günther, ii, 384: Leptecheneis nancrates Gill, Proc. Acad. Nat. Sci. Phila. 1864, 60. Echeneis nancrateoides Znieuw, Nova. Acta. Acad. Sci. Imp. Petropol. iv, 279. Leptecheneis nancrateoides Gill, Proc. Acad. Nat. Sci. Phila. 1864, 61, Echeneis albicanda Mitch. Amer. Monthly Mag. ii, 244. Echeneis lineata Holbr. Ichth. S. C. 1860, 102, and Echeneis holbrooki, Günther, ii, 382, are names applied to specimens with the disk comparatively long, but with only 21 Iaminæ.)

aa. Body rather robust; vertebræ 12 + 15. (Remora \* Gill.)
b. Dorsal rays about XVIII-23.

#### 658. E. remora L.-Remora.

Uniform dark brown. Body and tail comparatively robust, the latter compressed. Pectoral fins rounded, short, and broad, their rays soft and flexible; ventral fins adnate to the abdomen for more than half the length of their inner edge. Tip of lower jaw not produced into a flap. Vertebræ 12 + 15. Head broad, depressed Disk longer than the dorsal or anal fin. Maxillary scarcely reaching front of orbit. Caudal lunate; vertical fins rather high; pectoral  $\frac{3}{5}$  length of head. Head 4; disk  $2\frac{3}{4}$ ; width between pectorals  $5\frac{1}{4}$ . D. XVIII—23; A. 25. Warm seas, north to New York and San Francisco, usually found attached to large sharks.

(Echeneis remora L. Syst. Nat.: Echeneis jacobœu Lowe, Proc. Zoöl. Soc. London, 1839, 89: Echeneis remora Günther, ii, 378: Remora jacobœa Gill, Proc. Acad. Nat. Sci. Phila. 1862, 239.)

aa. Dorsal rays about XVI-30. (Remoropsis Gill.)

### 659. E. brachyptera Lowe.

Light brown, darker below; fins paler; body robust, the greatest depth nearly twice the length of the short pectoral fins; disk shorter than base of dorsal, rather broad; upper jaw angular. Caudal nearly truncate. Head nearly 4; width between pectorals 6½. D. XVI—30; A. 26. Warm seas, north to Massachusetts.

(Echeneis brachyptera Lowe, Proc. Zoöl. Soc. Lond. 1839, 89: Echeneis quatuordecemlaminutus Storer, Hist. Fish. Mass. 406: Echeneis brachyptera Günther, ii, 378: Remoropsis brachypterus Gill, Proc. Acad. Nat. Sci. Phila. 1864, 60.)

# 207.-RHOMBOCHIRUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 88: type Echeneis osteochir Cuv.)

This genus agrees with *Remora* in every respect excepting the structure of the pectoral fins. These are short and broad, rhombic in outline,

<sup>\*</sup>Gill. Proc. Acad. Nat. Sci. Phila. 1862, 239: type Echeneis remora L. (Remora, an ancient name, "holding back.")

the rays all flat, broad and stiff, being partially ossified, although showing the usual articulation; upper rays of pectoral broader than the others. One species known. ( $\delta \delta \eta \beta \eta \varepsilon$ , rhomb;  $\chi \varepsilon \varphi$ , hand.)

# 660. R. osteochir (Cuvier) Gill.

Light brown; underside of head, ventral line, part of ventrals and a spot on pectorals pale. Mouth very small, maxillary not nearly reaching to the line of the orbit. Disk very large, broader and rougher than in *Echeneis remora*, extending forwards beyond the tip of the snout. Caudal fin emarginate, with rounded angles. Head  $4\frac{2}{3}$  in length; disk  $2\frac{1}{4}$ ; width between pectorals 5. D. XVIII—21; A. 20; P. 20. West Indies, north to Cape Cod; parasitic on species of *Tetrapturus*.

(Echeneis osteochir Cuvier, Règne Anim: Echeneis osteochir Günther, ii, 381: Echeneis tetrapturorum Poey, Memorias, ii, 256.)

# Family LXXI.—ELACATIDÆ.

# (The Crab-eaters.)

Body elongated, fusiform, subsylindrical, covered with very small, smooth scales. Head rather broad, low, pike-like. Mouth rather wide, nearly horizontal, the maxillary about reaching front of eye; both jaws, vomer, palatines, and tongue with bands of short, sharp teeth; lower jaw longest. Premaxillaries not protractile. First dorsal represented by about eight low, stout, equal, free spines, each spine depressible in a groove; soft dorsal long and rather low, somewhat falcate, similar to and nearly opposite the anal; two weak anal spines, one of them free from the fin; ventrals thoracic, I, 5; caudal fin forked; no caudal keel; no finlets; no sucking-disk; no air-bladder. Branchiostegals 7. Pyloric cœca branched. Vertebræ more than 10 + 14. A single genus with probably but one species, a large, strong, voracious fish, found in all warm seas. (Scombridæ part, genus Elacate, Günther, ii, 375.)

#### 208 .- ELACATE Cuvier.

(Cuvier, Règne Anim. ed. 2d, 1829: type Elacate malabarica Cuv. = Gasterosteus canadus L.)

Characters of the genus included above. ( $\hat{\eta}\lambda az\hat{\alpha}\tau\eta$ , a spindle or an arrow, from the form of the body.)

#### 661. E. canada (Linn.) Gill.—Crab-cater; Cobia.

Olive brown, sides with a distinct broad band of darker, and a less distinct band above and below it; below silvery. Head much depressed. Month moderate, the short maxillary reaching front of orbit. Pectorals broad and falcate; caudal deeply emarginate, the upper lobe slightly

the longer. Lateral line wavy and irregular, descending posteriorly. Head  $4\frac{1}{4}$  in length; depth  $5\frac{9}{3}$ . D. VIII-I, 26; A. II, 25. L. 5 feet. In all warm seas, occasional on our Atlantic coast in summer.

(Gasterosteus canadus Linn, Syst. Nat.: Elacate atlanticus Cuv. & Val. viii, 334: Elacate nigra Günther, ii, 375; Holbrook, Ichth. S. Car. 97.)

# FAMILY LXXII.—XIPHIIDÆ.

(The Sword-fishes.)

Scombroid fishes of great size, with the body elongated, naked or covered with rough rudimentary scales, and the upper jaw very much prolonged, forming a "sword," which is composed of the consolidated vomer, ethmoid and premaxillaries. Teeth small and rudimentary, or wanting. Dorsal fin long, usually divided in the adult, continuous in the young, without differentiated spinous part, the posterior portion much smaller than the anterior. Anal fin similarly divided in the adult. Caudal peduncle slender, keeled. Ventral fins thoracic, incomplete or entirely wanting. Caudal fin widely forked in the adult. Gills of peculiar structure, the laminæ of each arch joined into one plate by reticulations. Gills 4, a slit behind fourth; gill-membranes separate, free from isthmus. Pseudobranchiæ present. Branchiostegals 7. Airbladder present. Pyloric cœca very numerous. Very young individuals differing much from the adults; the fins high, both jaws prolonged into a beak, and the head armed with long spines. Genera 3; species about 5; powerful fishes, inhabiting the open seas, most of them valued as food. (Xiphiida Günther, ii, 511-514.)

a. Ventral fins entirely wanting; teeth none. (Xiphiina)........XIPHIAS, 209. aa. Ventral fins present; teeth small. (Histiophorina.)

### 209.-XIPHIAS Linnaus.

# Sword-fishes.

(Linn. Syst. Nat.: type Xiphius gludius L.)

Sword-fishes without teeth and without ventral fins. Body somewhat compressed. Dorsal fins 2, the anterior beginning opposite the gill-openings, falcate and elevated, its height rather less than that of the body; second dorsal very small, on the tail, opposite the small second anal. In the young, teeth are present and the two dorsal fins are connected, the fin being elevated as in the species of *Histiophorus*. First anal similar to first dorsal, but smaller, less falcate, and far behind it;

pectoral fins moderate, falcate. Skin naked, more or less rough, especially in the young, which have rudimentary scales. Sword flattened. Caudal keel single. Intestines long, sinuous. Air-bladder simple. Pelvic arch obsolete. Fishes of great size, reaching a weight of 300 to 400 pounds, the flesh valued for food. ( $\xi \iota \varphi \iota a \xi$ , the ancient name of Xiphias gladius, from  $\xi \iota \varphi \circ \xi$ , a sword.)

#### 662. X. gladius L .- Common Sword-fish.

Very dark bluish above, dusky below; "sword" almost black above, below lighter. Cleft of mouth extending beyond eye. Head about  $2\frac{1}{4}$ ; depth about  $5\frac{1}{2}$ . Snout 3 in length. D. 40–4; A. 18–14. Vert. 14+12. Atlantic Ocean, on both coasts; also in the Pacific, north to the Santa Barbara islands.

(Linn. Syst. Nat.; Günther, ii, 511; Storer, Fish. Mass. 1867, 71.

# 210.—TETRAPTURUS Rafinesque.

# Spear Fishes.

(Rafinesque, Indice d'Ittiol. Sicil. 1810, 30: type *Tetrapturus belone* Raf. of the Mediterranean.)

Sword-fishes with small teeth in the jaws and on the palatines, with the ventral fins represented each by a single spine, and with the dorsal fin not greatly elevated, divided in the adult, its height not greater than the depth of the body. Body much compressed. Skin with rudimentary embedded scales; sword rounded; caudal keel double. Airbladder sacculated. Vertebræ 12 + 12. Intestine short, straight.  $(\tau \varepsilon \tau \rho a, \text{ four}; \tau \tau \varepsilon \rho \delta \nu, \text{ wing}; \sigma \delta \rho a, \text{ tail, from the wing-like caudal keels.})$ 

# 663. T. albidus Poey.—Bill-fish; Spear-fish; Aguja Blanca.

Dark blue above; whitish beneath; fins dark blue. Nape elevated, the greatest depth of the body opposite the opercle. Eye midway between opercle and tip of lower jaw. Dorsal inserted in front of base of pectorals. Caudal forked at an angle of 70 to 80 degrees. Head (to end of upper jaw)  $2\frac{2}{5}$ ; depth 7–8. Length of caudal lobes  $4\frac{1}{2}$ . D. III, 39–6; A. II, 13–6. Length 7 to 8 feet. (*Poey.*) Cape Cod to West Indies; not rare on our coast.

(Poey, Mem. ii, 237: ? Tetrapturus belone Raf. Histiophorus belone Günther, ii, 513.)

# 664. T. amplus Poey.—Aguja de Casta.

Color dark blue; paler below, with bluish cross streaks. Body stouter, more convex at the nape, the greatest depth being behind the opercle. Caudal forked at anangle of 90 to 100 degrees. Dorsal inserted

rather behind base of pectorals. Head  $2\frac{3}{5}$ ; depth 5. Length of caudal lobes  $3\frac{1}{3}$ . D. III, 38-7; A. II, 13-7. Length 8 feet. (*Poey.*) West Indies, north to Florida; perhaps a form of the preceding.

(Poey, Memorias, ii, 243.)

# 211.—HISTIOPHORUS Lacépède.

# Sail-fishes.

(Istiophorus Lacépède, Hist. Nat. Poiss. iii, 1802, 374: type Istiophorus gladifer Lac. = Scomber gladius Broussonet.)

Sword fishes with small teeth on the jaws and palatines, with the ventral fins present, of 2 or 3 rays, and with the dorsal fins extremely high, contiguous, its height much greater than that of the body; anal fin divided. Body slender, much compressed, covered with elongate scales. Intestines short, nearly straight; air-bladder sacculate. The sword is usually shorter than in *Xiphias*, and the lower jaw more developed. The skin is also rougher. Large fishes of the warm seas. ( $l\sigma\tau\iota\sigma\nu$ , sail;  $\varphi\sigma\rho\dot{\epsilon}\omega$ , to bear.)

# 665. H. gladius (Brouss.) Gthr.—Sail-fish.

Membrane of dorsal fin with numerous small spots. Dermal productions lanceolate. Upper profile of head descending in a straight line. Snout longer than the rest of the head. Head 4 in total length; depth 7 or 8 in the same. D. 46-7; A. 10-7; V. 2. Vertebræ 14+10. (Günther.) Atlantic and Indian oceans; occasional on our coast.

(Scomber gladius Brouss. Mem. Acad. Sci. 1786, 454; Günther, ii, 513: Histiophorus indicus Cuv. & Val. viii, 293: Histiophorus americanus Cuv. & Val. viii, 303.)

# FAMILY LXXIII.—TRICHIURIDÆ.

# (The Hair-tails.)

Scombroid fishes with the ventral fins imperfect or wanting and the spinous and soft parts of the dorsal not differentiated. Body extremely elongate, compressed, naked. Month wide, the jaws armed with strong unequal teeth. Premaxillaries not protractile. Pseudobranchiæ present. Gills 4, a slit behind the fourth; gill-membranes separate, free from the isthmus. Lateral line present. Dorsal fin very long, low, usually continuous, the rays all similar. Caudal fin small or absent; if present, forked. Anal fin very long and low, sometimes scarcely rising above the surface of the skin. Ventrals thoracic, rudimentary or wanting. Vertebræ of abdomen and tail in greatly increased number. Airbladder present. Pyloric cœca numerous. Genera about 5; species 12,

in the tropical seas. Very close to the *Scombrida*, from which group, as here understood, the *Trichiurida* differ chiefly in the non-differentiation of the dorsal spines. (*Trichiurida* part; Günther, 342–349.)

No caudal fin; tail tapering to a point; dorsal fin single; no ventral fins.

TRICHIURUS, 212.

### 212.—TRICHIURUS Linnaus.

### Hair tails.

(Lepturus Artedi: Gill.)

(Linnens, Syst. Nat. xii, 1765: type Trichiurus lepturus L.)

Body extremely elongate, band-like, the tail very slender, tapering to a fine point, without caudal fin. Head long, with a very wide mouth, the jaws armed with unequal and very strong teeth; upper jaw with about four long, strongly compressed barbed teeth; teeth on the palatines, none on the vomer. Lower jaw longest, preorbital covering cleft of mouth posteriorly. Dorsal fin single, low, occupying the whole of the back, the spines not distinguishable from the soft rays; anal very long, its base more than half the length of the body; composed of detached spines, which are very short, nearly hidden in the skin, the anterior directed backwards, the posterior forwards; ventral fins wanting or reduced to small, scale-like appendages; pectorals small. No scales. Lateral line decurved, concurrent with the belly. Vertebræ 39 + 120. Color silvery. Voracious fishes of the high seas; reaching a considerable size. (τριχίου, a little hair; οὐρά, tail.)

a. Ventral fins entirely wanting in the adult. (Trichiurus.)

#### 666. T. lepturus Linn.-Hair-tail.

Uniform brilliant silvery; dorsal dark-edged. Snoutlong and pointed, about as long as pectoral; maxillary reaching nearly to pupil, concealed by preorbital. Head about 7½ in length; depth about 16. Eye 2 in snout. D. 135; A. about 100. Warm seas, north to Virginia and Lower California.

(Linn. Syst. Nat. xii; Günther, ii, 346.)

# FAMILY LXXIV.—SCOMBRIDÆ.

(The Mackerels.)

Body elongate, not much compressed, covered with minute cycloid scales, or else wholly naked; the scales anteriorly sometimes forming a corselet. Lateral line present, its course undulate. Head subconic,

pointed anteriorly. Mouth rather large; premaxillary not protractile; maxillary without supplemental bone; jaws with sharp teeth, large or small. Vomer and palatines toothed or not. Preopercle entire; opercle marmed. Gill-openings very wide, the membranes not united, free from the isthmus. Gill-rakers usually long. Pseudobranchiæ present, large. A slit behind fourth gill. Branchiostegals 7. Dorsal fins 2, the first of rather weak spines, depressible in a groove, the second similar to the anal; anal spines weak; last rays of dorsal and anal usually detached and separate, forming series of finlets; candal peduncle extremely slender, usually keeled, the candal lobes abruptly diverging, falcate; ventral fins moderate, thoracic, I, 5. Vertebræ in greater number than in Carangidæ, the number more than 25. Pyloric cæca numerous. Air-bladder frequently absent. Coloration metallic, often brilliant. Genera 17; species about 70. Fishes of the high seas, many of them cosmopolitan, and all having a wide range. Most of them are valued as food-fishes.

(Scombridæ pt. and Trichinridæ pt. Günther, ii, 349-373.)

- a. Finlets present; dorsal spines less than 20. (Scombring.)
  - b. Spinous dorsal short (of less than 12 spines), remote from the second.

  - bb. Spinous dorsal long (of more than 12 spines), contiguous to the second.
    - d. Candal keel present.
      - - f. Palatine teeth strong; vomer toothless; vertebræ normal...SARDA, 216. ff. Palatine teeth villiform.
          - q. Vomer with teeth; vertebræ normal, the lower foramina small.

Orcynus, 217.

gg. Vomer toothless; abdominal vertebræ with the lower foramina enlarged and a portion between the vertebræ proper and the hæmapophyses developed in the form of a net-work or trellis....EUTHYNNUS, 218.

#### 213.—SCOMBER Linnaus.

#### Mackerels.

(Linnæus, Syst. Nat. 1758: type Scomber scombrus L.)

Body fusiform, rather elongate, somewhat compressed; caudal peduncle slender, with two small keels on each side. Mouth wide, with a single row of rather small, slender teeth in each jaw and on the vomer and palatines; maxillary slipping under the broad preorbital. Scales very small, not forming a corselet. First dorsal of 7–12 feeble spines, separated from the second by an interspace greater than the base of the fin; second dorsal small, followed by 5–9 detached finlets; anal similar to second dorsal, with similar finlets; pectorals and ventrals small, the

former on a level with the eyes; caudal fin small, widely forked. Pyloric appendages exceedingly numerous. Air-bladder usually wanting. Species few, widely distributed, everywhere highly valued for food. ( $\sigma x \delta \mu \beta \rho \sigma s$ , Latin Scomber, the ancient name of the common mackerel.)

a. Air-bladder present, small.

# 667. S. paetimatophorus De la Roche.—Chub Mackerel; Tinker Mackerel; Easter Mackerel.

Blue, with about 20 wavy, blackish streaks, which extend to just below the lateral line; some of these form reticulations, and inclose pale spots of the color of the back; belly and sides silvery; a black axillary spot. Head rather pointed. Maxillary reaching front of pupil. Eye 4 in head, nearly equal to snout; pectoral \(^2\_5\) length of head. Head \(^3\)\(^3\_4\); depth 5. D. IX—I, 12—V; A. I—I, 11—V. Lat. l. 200. L. 1 foot. Atlantic and Pacific, north to Maine and San Francisco; common in the Mediterranean and in Southern California; irregular in its appearance on our Atlantic coast.

(De la Roche, Ann. Mus. Nat. Hist. xiii, 315; Günther, ii, 359; Scomber grex Mitch. Trans. Lit. & Phil. Soc. N. Y. 1815, 422; Scomber dekayi Storer, Fish. Mass. 1867, 52; Scomber diego Ayres, Proc. Cal. Acad. Nat. Sci. i, 92, 1855; Scomber colias pt. Steindachner, nec Scomber colias of Günther and C. & V., which has but 7 dorsal spines.)

aa. Air-bladder wanting.

#### 668. S. scombrus L.-Common Mackerel.

Lustrous dark blue above, with about 35 wavy, blackish, transverse streaks; below silvery; base of pectorals dark. Snout rather long and pointed, compressed. Mouth large, maxillary extending to anterior margin of orbit. Ventrals and pectorals short, the former nearly half length of head. Eye less than snout, 5 in head. Head 4 in length; depth 5½. D. XII—I, 10—V; A. I, 11—V. L. 18 inches. North Atlantic; abundant on both coasts, and occasionally straying to the Pacific. A well-known food-fish.

(Linn. Syst. Nat.: Scomber scomber Günther, ii, 357: Scomber vernalis Storer, Hist. Fish. Mass. 54.)

#### 214 .- AUXIS Cuvier.

# Frigate Mackerels.

(Cuvier, Règne Anim. 1829, ii: type Scomber rochei Risso.)

Body oblong, plump, mostly naked posteriorly, anteriorly covered with small scales, those of the pectoral region enlarged, forming a corselet. Snout very short, conical, scarcely compressed. Mouth rather small,

the jaws equal. Teeth very small, mostly in a single series, on the jaws only. Tail very slender, depressed, with a rather large keel on each side. First dorsal short, separated from the second by a considerable interspace. Second dorsal and anal small, each with 7 or 8 finlets. Pectorals and ventrals small. No air-bladder. Branchiostegals 7. Pyloric ecca dendritical. Gill-rakers very long and slender, numerous. Vertebrae peculiarly modified, essentially as in Euthynnus. ( $ab\bar{z}c$ , an ancient name of a young tunny, from  $ab\bar{z}\omega$ , to grow.)

# 669. A. rochei (Risso) Günther.—Frigate Mackerel.

Blue, variegated with darker above, becoming plain with age; belly silvery. Body robust, searcely compressed, abruptly contracted at caudal peduncle. Eye as long as snout, 5 in head. Opercle very broad. Scales of corselet and along anterior dorsal region comparatively large. Maxillary almost entirely concealed by preorbital. Dorsal spines rather stiff; space between dorsals four-fifths length of head. About 33 gill-rakers below angle. Pectoral reaching past middle of first dorsal. Head 4; depth 4½. D. X-12-VIII; A. 13-VII. Vert. 39. Mediterranean to the East Indies; lately appearing in great numbers on our Atlantic coast. A food-fish of little value.

(Scomber rochei Risso, Ichth. Nice, 1810, 165; Günther, ii, 369: Scomber bisus Rafinesque, Caratteri, etc. 1810, 45: Auxis vulgaris Cuv. & Val. viii, 139.)

#### 215.—SCOMBEROMORUS Lacépède.

(Cybium Cuvier.)

(Lacépède, Hist. Nat. Poiss. iii, 292, 1802: type Scomberomorus plumierii Lac. = Scomber regalis Bloch.)

Body elongate, naked or with rudimentary scales, which do not form a distinct corselet. Head pointed, comparatively short and small. Mouth wide, the strong teeth in the jaws often compressed or knife-shaped; villiform or sand-like teeth on the vomer and palatines; maxillary not concealed by preorbital. Spinons dorsal low, of 14–18 feeble spines. Soft dorsal and anal short, similar, somewhat elevated and falcate, each followed by 7 to 10 finlets; ventrals small; pectorals moderate, near the level of the eye. Air-bladder present. Vertebrae normal. Fishes of the high seas; graceful in form and beautiful in color; among the best of food-fishes. ( $\sigma zop_{\beta}\rho \sigma z$ , Scomber;  $\delta \mu o\rho \sigma z$ , near.)

#### 670. S. concolor (Lockington) J. & G.

Male dark steel-blue, the sides silvery, without streaks or spots; female with two alternate series of brown spots, the silvery on sides

clouded with dusky; fins nearly plain, dark. Mouth slightly oblique, the maxillary reaching to posterior margin of pupil. Teeth of jaws comparatively small, subconical, little compressed; those of vomer and palatines minute and granular. Eye  $5\frac{1}{2}$  in head. Pectoral fins 8 in length, inserted rather above axis of body; ventral fins small; spines of dorsal slender and fragile, the longest one-fourth as long as the head; dorsal fins separated by an interspace equal to one-third the length of base of spinous dorsal; caudal shorter than head, its lower lobe longest. Gillrakers long, 18 below angle. Head about 5; depth rather less. D. XVII-16-VIII; A. I, 16-VIII. Monterey Bay, California; rare. A food-fish of high quality.

(Chriomitra concolor Lockington, Proc. Acad. Nat. Sci. Phila. 1879.)

# 671. S. maculatus (Mitch.) J. & G. -Spanish Mackerel.

Bluish and silvery above with bright reflections; sides with numerous bronze spots which are nearly round and about as large as the pupil. Spinous dorsal white at base, dark above and on the anterior half of the fin. Caudal keel well developed, with a smaller keel above and below it. Head small and pointed. Mouth rather large, oblique; maxillary reaching posterior margin of orbit. Teeth large, compressed, about 32 in each jaw. Gill-rakers few, slender, about 12 below angle. Interspaces between dorsals shorter than eye; caudal as long as head. Head  $4\frac{3}{4}$  in length; depth  $5\frac{1}{4}$ . D. XVIII-18-IX; A. II, 17-VIII. Coasts of North America, north to Cape Cod and Lower California; one of our most valued food-fishes.

(Seember maculatus Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 426, 1815: Cybium maculatum Günther, ii, 372: Cybium maculatum Holbrook, Ichth. S. Car. 66.)

#### 672. S. regalis (Bloch) J. & G.-Cero.

Silvery; sides with a brownish, broken, longitudinal band, above and below which are numerous brownish spots, persistent in the adult; anterior portion of spinous dorsal black. Body rather elongate, its dorsal and ventral curves about equal. Lateral line descending obliquely, slightly undulate along the tail. Month large; maxillary reaching to below eye. Teeth triangular, strongly compressed, about 20–16. Pectoral scaly. Head 4 in length; depth 4½. D. XVII-I, 15–VIII; A. II, 15–VIII. Cape Cod to Brazil; not common on our Atlantic coast; reaches a weight of 20 pounds.

(Scomber regalis Bloch, Ausl. Fische, taf. 333: Cybium regale Günther, ii, 372: Scomberomorus plumierii Lac. iii, 292: Cybium acervum C. & V. viii, 1831, 186: Cybium regale Poey, Proc. U. S. Nat. Mus. 1878, 4.)

# 673. S. caballa (Cuv. & Val.) J. & G.—Sierra.

Sides of body with indistinct darker yellowish spots; adult immaculate; spinous dorsal without black blotch anteriorly. Eye large. Month large, maxillary reaching to below eye. Lateral line descending abruptly below the second dorsal. Teeth triangular, strongly compressed, about 30–25. Pectoral scaly at base only. D.XIV-I, 15–VIII; A. II, 15–VIII. (*Poey.*) Warm parts of the Atlantic; occasional on our coast; reaches a weight of 100 pounds.

(Cybium caballa Cuv. & Val. viii, 1831, 187: Cybium caballa Giinther, ii, 373: Cybium immaculatum C. & V. viii, 191: Cybium caballa Poey, Proc. U. S. Nat. Mus. 1878, 4.)

### 216 .- SARDA Cuvier.

#### Bonitos.

(Pelamys Cuv. & Val. 1831, preoccupied in Herpetology.)

(Cuvier, Règne Anim. ed. 2d, ii, 1829: type Scomber pelamys Brünnich = Scomber sarda Bloch.)

Body rather elongate, covered with small scales, those of the pectoral region forming a corselet. Caudal peduncle slender, strongly keeled. Head large, pointed, compressed. Mouth large. Teeth in the jaws rather strong, conical, slightly compressed; similar teeth on the palatines, but none on the vomer: maxillary not concealed by preorbital. Gill-rakers long and strong. First dorsal long and rather low, of 18-22 rather stout spines, which are gradually shortened behind; interval between the last spine and the second dorsal short; second dorsal small, followed by 8-9 finlets; anal fin similar, usually with one less finlet; paired fins small; pectorals placed below the level of the pupil. No air-bladder. Pylorie cœca very numerous, dendritical. Vertebræ nor-Fishes of rather large size, with metallic coloration. (Latin, sarda; Greek, σάρδα, the ancient name of the typical species, also known as Amia, Pelamys, etc.; so called from its being taken in the neighborhood of the island of Sardinia; hence also the diminutive σαρδίνη, the Sardine.)

### 674. S. mediterranea (Bloch & Schneider) J. & G.-Bonito; Skip-jack.

Dark steel-blue above, with numerous narrow, dark stripes from the back obliquely downwards and forwards; silvery below. Body elongate, scarcely compressed, robust; corselet distinct, small, not extending beyond pectoral. Teeth moderate, slightly compressed. Gill-rakers rather small, 13 below angle. Maxillary reaching beyond orbit. Head 3\frac{3}{4} in length; depth 4. D. XXI-I, 13-VIII; A. I, 13-VII; P. 10. L. 2\frac{1}{2} feet.

Atlantic Ocean, on both coasts; abundant; a food-fish of rather low grade.

(Scomber pelamys Brünnich, Ichth. Massil. 1768, 69, not of L. Syst. Nat.: Scomber mediterraneus Bloch & Schn. 1801, 23: Pelamys sarda Storer, Fish. Mass. 63: Pelamys sarda Günther, ii, 367: Sarda pelamys Gill.)

# 675. S. chilensis (Cuv. & Val.) J. & G.—Bonito; Skip-jack; Tuna.

Dark metallic blue; sides dusky; about 5 blackish stripes running obliquely npward and backward from the pectoral region to the upper edge of the tail, these variable in number and direction. Head pointed, conical, naked. Maxillary reaching posterior border of eye. Pectorals placed just below the level of the pupil, scarcely half as long as head. Gill-rakers long, strong, about 18 below angle. Corselet moderately developed. Head  $3\frac{3}{4}$ ; depth about 4. D. XVIII-I, 12-VIII; A. II, 11-VI. L. 2-3 feet; weight 16 pounds. San Francisco to Patagonia and Japan; abundant northward in summer; very similar to the preceding but with the spinous dorsal always shorter.

(Pelamys chilensis Cuv. & Val. viii, 163: Pelamys lineolata Girard, U. S. Pac. R. R. Surv. Fish. 106: Pelamys chilensis Günther, ii, 106: Pelamys orientalis Günther, ii, 106.)

#### 217.-ORCYNUS Cavier.

#### Tunnies.

(Thynnus Cuvier, 1817, preoccupied in entomology.)

(Cuvier, Règne Anim. 2d ed. 1829: type Scomber thyunus L.)

Body oblong, robust, with very slender caudal pedancle. Head conical. Mouth wide, with one series of small, conical teeth in the jaws and bands of minute villiform or sand-like teeth on the vomer and palatines. Scales present, those of the pectoral region forming an obscure corselet. First dorsal of 12–15 spines which grow gradually shorter backward, the interval between last spine and second dorsal slight; second dorsal and anal short and rather high, each with 8–10 finlets; ventrals moderate; pectorals moderate or very long, rather below the level of the eye. Vertebræ normal, the lower foramina very small. Fishes of the open seas; often attaining a very great size. (δρεόνος, an ancient name of O. thynnus.)

a. Pectoral fins sabre-shaped, reaching beyond end of second dorsal. (Albicores.)

# 676. O. alalonga (Gmel.) Risso.—Albicore; Alilonghi; Germon.

Bright metallic steel-blue; belly bluish silvery; fins colored like the body; pectorals blackish, with silvery lustre. Body little compressed, regularly elliptical, its weight great in proportion to the length. Tail

strongly keeled, broader than deep. Corselet indistinct. Scales rather large. Pectoral reaching beyond second dorsal and anal, inserted a little below level of pupil, its base a little wider than the large eye; ventrals short. Head 3½; depth 3½. D. XIV-II, 12-VIII; A. II, 12-VII. L. 3 feet; weight 15-20 pounds. In all warm seas, in the open ocean; abundant in summer in the Mediterranean and about the Santa Barbara Islands; occasional on our Atlantic coast.

(Scomber alatunga Gmel. Syst. Nat. 1788, 1330, misprint for alalonga, fide Cuv. & Val.: Thynnus alalonga Cuv. & Val. viii, 120: Thynnus pacificus Cuv. & Val. viii, 133: Thynnus albacora, alalonga, and pacificus Günther, ii, 365, 366: Oregnus pacificus Cooper, Proc. Cal. Acad. Nat. Sci. 1863, 75: Oregnus germo Lütken, Spolia Atlantica, 1880, 473.)

a. Pectoral fins comparatively short, not reaching beyond the end of the spinous dorsal. (Tunnies.)

# 677. O. thymnus (Linn.) Poey .- Tunny; Horse Mackerel; Albicore.

Dark blue above; below greyish with silvery spots. Mouth rather large; posterior margin of preopercle somewhat shorter than inferior. Eye small. Dorsal and anal falcate; caudal very widely forked; pectorals reaching nearly to end of spinous dorsal. Head 3\frac{3}{4} in length; depth 4. D. XIV-I, 13-IX; A. I, 12-VIII. North Atlantic, on both coasts; the largest of the *Scombrida*, reaching a length of 10 feet or more and a weight of half a ton.

(Scomber thynnus Linn. Syst. Nat.: Thynnus secundo-dorsalis Storer, Fish. Mass. 65: Thynnus thynnus Günther, ii, 362: Thynnus vulgaris C. & V. viii, 58: Thynnus brachypterus and coretta Günther, ii, 363.)

#### 218.—EUTHVNNUS Lütken.

#### Little Tunnies.

(Thynnus Lütken: Thynnichthys Giglioli; both names preoccupied.) (Lütken MSS, in Epist. Feb. 1881: type Thynnus thunnina C. &. V.)

This genus differs from *Orcynus*, according to Lütken\*, "(1) in the absence of teeth on the vomer; (2) by the complete absence of scales outside of the corselet, while in the *Orcyni* of the same size the skin is covered with small scales; the limits of the corselet in the Tunny and Albicore are obscure, so that it cannot properly be said that they have distinct corselets; and (3) by an important osteological character, namely the peculiar development, in the form of a net-work or trellis, of a portion of the abdominal part of the backbone, between the vertebræ proper and the hæmapophyses. This organization is common to *Th. thunnina* (alliteratus) and *Th. pelamys*, and is found modified in

<sup>\*</sup> Spolia Atlantica, 1880, 596.

the genus Auxis." Species of smaller size than the Tunnies, mostly pelagic. (*Baird*.) ( $\varepsilon o$ , true;  $\theta o \nu \nu o \varepsilon$ , tunny.)

# 678. E. alliteratus (Raf.) J. & G.-Little Tunny; Albicore.

Bluish above with wavy, blackish, longitudinal streaks; silvery below. Inferior margin of preoperculum half longer than posterior. Dorsal spines moderate; pectorals reaching the vertical from the ninth dorsal spine. Head 3\frac{3}{4} in length; depth 4\frac{1}{2}. D. XV-I, 12-VIII; A. I, 12-VII. Atlantic Ocean; occasional on our coast.

(Scomber alliteratus Raf. Caratteri di Alcuni Nuovi Generi, 1810, 46: Thynnus affinis, thannina, and brerirostris Günther, ii, 363-365.)

# 679. E. pelamys (L.) Liitken. - Oceanic Bonito.

Back bluish; on each side of the belly 4 brownish longitudinal bands. Length of posterior margin of the preoperculum  $1\frac{2}{3}$  in that of the inferior. Pectoral reaching the vertical from the tenth dorsal spine; dorsal spines rather feeble. Head  $3\frac{1}{2}$ ; depth 4 (to fork of caudal). D. XV-I, 12 + VIII; A. II, 12 + VIII. (Günther.) Tropical seas; occasional on our Atlantic coast.

(Scomber pelamys L. Syst. Nat.: Thynnus pelamys Günther, ii, 365: Thynnus pelamys Cuv. et Val. viii, 113.)

# FAMILY LXXV.—CARANGIDÆ.

# The Pilot fishes.

Scombroid fishes, with the body more or less compressed and often elevated, sometimes naked, or more usually covered with small, thin, eycloid scales. Head compressed, the occipital keel prominent, usually trenchant. Mouth of varying size, the dentition various, the teeth generally small; premaxillaries usually protractile; maxillary with or without a supplemental bone; preopercle usually entire in the adult, in the very young armed with three or more spines.\* Lateral line complete, anteriorly arched, the posterior part straight, sometimes armed with bony plates. Dorsal fins more or less separated, the spinous part rather weak, the spines usually depressible in a groove; anal fin long, similar to the soft dorsal, always preceded by two stiff spines, usually separate, but in the young often more or less connected with the fin or with each other; these sometimes disappear with old age, and sometimes the spinous dorsal also vanishes; often a procumbent spine before the dorsal fin; ventral fins thoracie, well developed, I, 5; caudal peduncle very slender, the fin widely forked; pectoral fins narrow. Gill-openings very wide, the membranes usually not united, free from the isthmus. Gills 4, a slit

<sup>\*</sup>For an account of the transformations of various members of this family, see Lütken, Spolia Atlantica, 1880.

BLEPHARIS, 222.

behind the last. Gill-rakers usually long. Branchiostegals commonly 7. Air-bladder present, often bifurcate behind. Pseudobranchiæ large, present in all our genera, sometimes disappearing with age. Œsophagus unarmed. Pyloric cœca generally numerous. Vertebræ fewer than in the *Scombridæ*, about 25 in number. Coloration generally metallic and silvery. Genera 25; species about 180, abounding in warm seas, often moving northward in summer, like the *Scombridæ*. Most of the species are widely distributed, and nearly all are valued as food.

(Carangida pt. Günther ii, 417-485, exclusive of certain genera.)

- \* Lateral line armed with bony keeled plates, at least posteriorly. (Carangina.)

  a. Armature of lateral line extending its whole length..........Trachurus, 219.

  aa. Armature of lateral line on its straight posterior portion only.
- \*\* Lateral line unarmed.
  - d. Premaxillaries protractile.
    - c. Anal fin about equal to the soft dorsal, its base longer than the abdomen; tail not keeled.
      - f. Thoracic region trenchant; body excessively compressed.
        - g. Dorsal outline more convex than the ventral outline; profile very steep; head very short and high; preorbital very deep. (Sclening.)
      - ff. Thoracic region not trenchant; body moderately compressed. (Tra-chunoling.)
    - - i. Finlets none.

        - jj. Dorsal spines connected by membrane ....... Seriola, 227.
  - ii. A two-rayed finlet behind dorsal and anal......ELAGATIS, 228.
     dd. Premaxillaries not protractile; dorsal and anal with finlets; maxillary
    - very narrow, without distinct supplemental bone. (Scombroidina.).....Scombroides, 229.

## 219.—TRACHURUS Rafinesque.

### Saurels.

(Rafinesque, Indice d'Ittiologia Siciliana 1810, 20 : type Scomber trachurus L. = Trachurus saurus Raf.)

Body rather elongate, somewhat compressed, not elevated, tapering to a slender caudal peduncle, which is as broad as deep. Scales present, not very small. Lateral line armed throughout with plates, those on the caudal peduncle larger and spinous; an accessory dorsal branch to the lateral line. Snout rather long. Mouth moderate. Minute teeth mostly

in single series on jaws, vomer, and palatines. Dorsals two, the first preceded by a procumbent spine. No finlets. Two strong spines before the anal, connected by membrane. Pyloric execa numerous. In all warm seas. ( $\tau \rho a \chi o \dot{\nu} \rho a z$ , the ancient name of T. saurus; from  $\tau \rho a \chi o z$ , rough;  $o u \rho a$ , tail.)

## 680. T. svenmetrious (Ayres) Girard.—Horse Mackerl.

Similar to T. saurus, but slenderer and less compressed. Arch of lateral line longer, as long as straight part, the junction of the two much beyond tip of pectoral; plates on the anterior part small, crowded, their height less than half eye. Head  $3\frac{3}{4}$ ; depth  $4\frac{2}{3}$ . D. VIII-I, 31; A. II-I, 27; Lat. l. 48+47. Coast of California, from San Francisco southward; very abundant in summer.

(Caranx symmetricus Ayres, Proc. Cal. Acad. Nat. Sci. i, 1855, 62; Girard, Pac. R. R. Surv. Fish. 107.)

## 981. T. Saurus Raf.—Horse Mackerel; Skip Jack; Saurel.

Greenish, sides silvery; a dusky opercular spot. Body more compressed and deeper than in the preceding. Head rather long. Month moderate, the maxillary reaching the front of eye. Eye large, equal to snout, 4 in head; arch of lateral line short, reaching scarcely beyond pectoral,  $1\frac{1}{3}$  in straight part, the plates high, nearly as high anterioriy as posteriorly, their height more than half eye. Head  $3\frac{1}{2}$ ; depth 4. D. VIII-I, 29; A. II-I, 28; Lat. l. 40 + 37. L. 1 foot. Southern Europe; occasional on our South Atlantic coast.

(Scomber trachurus Linn. Syst. Nat. i, 1758: Caranx trachurus Lacépède, iii, 63: ? Caranxomorus plumierianus Lacép. Hist. Nat. Poiss. iii, 84: ? Selar japonicus Bleeker, Verh. Bat. Gen. xx, vi, Japan, pl. 8: Trachurus saurus Rafinesque, l. c. 20: Trachurus trachurus Günthei, ii, 419.

### 220. DECAPTERUS Bleeker.

### Mackerel Scads.

(Bleeker, Natuurk. Tydschr. 1855, v, 417: type Caranx kurra Cuv. & Val.)

Body elongate, little compressed, almost perfectly fusiform. Head short, pointed. Mouth rather small; jaws about equal, the dentition feeble. A supplementary maxillary bone. Premaxillaries protractile. Scales moderate, enlarged and spinous along lateral line posteriorly; second dorsal and anal each with a single detached finlet; free anal spines very strong. Abdomen rather shorter than anal fin. Gill-rakers long and slender. Species numerous. (δεκάς, ten; πτερόν, fin; there being ten fins, counting the spurious finlets and excluding the free spines.)

## 682. D. punctatus (Agassiz) Gill.—Scad; Round Robin.

Bluish above, silvery below; a dark opercular spot. Eye rather small, shorter than snout, about equal to the width of cheeks or the in-

terorbital space. Maxillary reaching front of eye. Teeth on vomer and palatines, none on tongue; teeth in jaws in single series. Lateral line little arched; arch of lateral line nearly as long as straight part. Scutes numerous, deep, crowded, about 40. Pectorals short, shorter than head. Breast, cheeks, and top of head scaly. Depth 5 in length; head  $4\frac{1}{3}$ . D. VIII-I, 30-I; A. II-I, 24-I. L. 12 inches. New York to the West Indies: not common on our coast.

\* (Caranx punctatus Agassiz, Spix. Pisc. Bras. 1829, 108: Caranx punctatus Günther, II, 426.)

# 683. D. macarellus (Cnv. & Val.) Gill.—Mackerel Sead.

Silvery, plumbeous below; a small black spot on the operele. Lateral line nearly straight. Head 5; depth 6. D. VIII-1, 33-I; A. II—I, 27-I; scutes 25. (*Günther*.) Warm parts of the Atlantic, northward to Cape Cod; scarce on our coast.

(Caranx macarellus Cuv. & Val. ix, 40: Caranx macarellus Günther, ii, 426.)

## 221.—CARANX Lacépède.

## Crevallés.

(Caranx, Carangops, Carangus, Paratractus, and Trachurops Gill; Caranx, Gnathanodon, Selar, Carangoides, Carangichthys, etc. Bleeker.)

(Commerson; Lacépède Hist. Nat. des Poiss. 1802, iii, 72: type Scomber speciosus Forskâl.)

Body ovate or oblong, compressed, the back sometimes considerably elevated, sometimes little arched. Head moderate or rather large, more or less compressed. Mouth moderate or large, oblique; maxillary with a well-developed supplemental bone, extending to below the eye. Premaxillaries protractile. Teeth variously developed; sometimes minute, granular, and deciduous (Caranx), sometimes with an outer row of stronger teeth (Selar, etc.) or with small canines (Carangus); villiform teeth often present on vomer, palatines, and tongue. Gill-rakers long. Eye large, with an adipose eyelid. Dorsal spines rather low, connected; second dorsal long, elevated in front; both fins depressible in a groove. Anal fin similar to second dorsal and nearly as long, preceded by two rather strong spines, its base longer than the abdomen. Caudal fin strongly forked, the peduncle very slender. Ventral fins moderate; pectorals falcate; no finlets. Scales present, usually very small. Lateral line with its posterior portion armed with strong bony plates, which grow larger on the tail, each plate armed with a spine; a short dorsal branch of lateral line, usually present. Preopercle entire in the adult, serrate in the young, usually with a membranaceous border. Species

Bull. Nat. Mus. No. 16—28

very numerous in all warm seas, most of them valued for food. As here understood, this genus includes a considerable variety of forms, differing in the dentition and in the shape of the body. Its members seem, however, to form an almost unbroken series from one extreme to another. (zápa, head. "À cause de l'espèce de prominence que presente leur tête, de la force de cette partie, de l'éclat dont elle brille, et d'ailleurs pour annoncer la sorte de puissance et de domination que plusieurs osseux de ce genre exercent sur un grand nombre des poissons que frequentent les rivages" Lacépède).

Our species may be divided as follows:

- a. Teeth present, small, nearly uniform, or the outer somewhat enlarged; no canines. (Selar Bleeker.)
  - b. Body fusiform, elongate \_\_\_\_\_\_\_ crumenophthalmus.
    bb. Body ovate or subfusiform.
    - c. Depth one-third or less than one-third the length to base caudal.

pisquetus; caballus; cibi.

- a. Teeth present, small, nearly uniform; the outer row sometimes enlarged; no canines. (Selar\* Bleeker.)
  - b. Body fusiform, elongate. (Trachurops Gill.)

# 684. C. crumenophthalmus (Bloch) Lac.—Goggler; Big-eyed Scad.

Bluish olive above, silvery below, a faint opercular spot. Body oblong-elongate, little compressed, the back not elevated. Head elongate, rather pointed, the lower jaw projecting; maxillary reaching past the front of the eye, which is very large, longer than snout, about 3 in head. Eve much deeper than the cheeks and greater than the interorbital width. A single series of small teeth in each jaw; very weak teeth on vomer and palatines; a patch of teeth on tongue. Shoulder-girdle near isthmus with a fleshy projection, in front of which is a deep cross-furrow; adipose evelid largely developed. Scales comparatively large. Cheeks and breast scaly. Gill-rakers long, numerous. Lateral line searcely arched, its seutes weak, but little carinated. Dorsal spines slender; free anal spines strong; pectorals falcate, nearly as long as head. An angle at lower posterior part of opercular region as in Clupea. Head 31; depth 31. D. VIII-I, 26; A. II-I, 22; scutes 35. Cape Cod to Madagascar; abundant in tropical seas.

(Scomber crumenophthalmus Bloch, taf. 343; Günther, ii, 429: Trachurops crumenophthalmus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 431.)

bb. Body ovate or subfusiform.

c. Depth one-third or less the length to base of caudal.

<sup>\*</sup> Bleeker, Natuurk. Tydschr. 1855, v, 417.

# 685. C. pisquetus Cuv. & Val.—Crevallé.

Greenish olive, golden vellow below; a black blotch on opercle. Body oblong, moderately elevated, the dorsal and ventral outlines about equally arched. Profile forming a uniform curve. Snout rather sharp. Month slightly oblique, a little below axis of body. Maxillary reaching about to middle of orbit. Teeth comparatively large; a single series in lower jaw: upper jaw with an inner series of smaller teeth; no canines; teeth on yomer, palatines, and tongue. Eve rather small, shorter than snort, 31 in head. Gill-rakers long, numerous. Pectoral as long as head, barely reaching anal, its broad basal part half its length. Scales moderate: cheeks and breast scaly. Top of head naked, with series of mucous pores. Lateral line with a weak arch anteriorly, which is about half length of straight portion. Lateral scutes numerous, developed on whole straight part of lateral line. Head 33; depth 3. VIII-I, 24; A. II-I, 19; Lat. l. 50 (seutes). L. 1 foot. Cape Cod to West Indies: the most abundant of the Carangidae on our Atlantic coast northward.

(Cuv. & Val. ix, 97: Caranx hippos Holbr. Ichth. S. C. 1860, 90: Paratractus pisquetus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 432: Caranx chrysos Günther, ii, 445.)

### 686. C. caballus Günther.

Greenish above, silvery below; a black blotch on the opercle, none elsewhere. Form of C. pisquetus; rather elongate, not greatly compressed; the dorsal and ventral outlines regularly and nearly equally arched; a low occipital carina; a prominent supraocular ridge. Scales comparatively large, the sealy sheaths of the vertical fins well developed. Cheeks and upper part of opercles scaled; breast scaled, jaws naked. Teeth in a narrow band above, those in front somewhat enlarged, those of lower jaw mostly in one series; feeble teeth on tongue, vomer, and palatines. Mouth rather small, the jaws nearly equal; maxillary reaching front of pupil. Eye large, 31 in head, the adipose eyelid unusually developed. Gill-rakers numerous, very long and slender, 28 below augle. Curve of lateral line low, the straight part beginning under first ray of second dorsal, at a distance rather more than length of head; length of arch 12 in straight part. Scutes of lateral line strong. Pectoral fins very long, slender, and falcate, their length considerably more than that of the head; a little less than 3 times in length of body, their tips reaching fourth anal ray; the broad basal part forming little more than onethird the total length of the fin; ventrals short; a concealed spine before dorsal; second dorsal and anal a little elevated in front, the longest ray nearly half length of head, the last rays of the fin searcely rising above the sealy sheath. Head 4; depth 3½. D. VIII-I, 24; A. II-I, 21; Lat. l. 41 (developed seutes). San Diego, Cal., to South America. (Description from original types of *T. boops.*)

(Trachurus boops Girard, U. S. Pac. R. R. Surv. Fish. 1859, 108, not Caranx boops of C. & V.: Caranx caballus Günther, Trans. Zoöl. Soc. Lond. 1869, 431: Caranx girardi Steindachner.)

### 687. C. cibi Poey.

Dusky bluish, golden below, without spots. Body rather elongate, not elevated, muzzle pointed. Profile regularly curved. Maxillary reaching front of eye. Teeth villiform on jaws, vomer, and palatines. Breast and vertical fins scaly. Last spine of dorsal short, strong, free. Pectorals as long as depth of body, falcate; ventrals short. Eye 4½ in head. Head 3⅓; depth 3. D. VIII-I, 25; A. II-I, 22. West Indies, north to Florida.

(Poey, Memorias, ii, 224, 1858.)

cc. Depth more than one-third the length.

### 688. C. beani Jordan.

Silvery, bluish above; no black spot on opercles or fins; spinous dorsal and axil dusky. Body ovate, deep and compressed, somewhat elliptical; the profile anteriorly not elevated, forming an even curve continuous from the snout to the base of the dorsal, the snout therefore not blunt. Top of head not much compressed. Premaxillaries on the level of the lower edge of the pupil; maxillary not reaching to opposite the front of the pupil. Teeth rather small, in a narrow band on each jaw, without distinct canines; villiform teeth on tongue, vomer, and palatines. Cheek about as deep as the eye, which is rather small, considerably shorter than snout; adipose eyelid little developed. Gill-rakers long. Breast entirely scaly; soft parts of the vertical fins densely covered with small scales. Pectoral fin falcate, a little shorter than the head, reaching past the front of the anal; caudal equally forked. Plates of lateral line small. Head 3\frac{1}{3}; depth 2\frac{1}{3}. D, VIII-I, 27; A. II-I, 23; Lat. 1. 28. Beaufort, North Carolina.

(Jordan, Proc. U. S. Nat. Mus. 1880, 486.)

### 689. C. falcatus Holbr.

Greenish above with blue reflections, sides and below golden or silvery; eaudal fin yellow, inner edge of upper lobe black; a black axillary spot, opercle faintly blotched. Body oval, much compressed, with the axis nearly midway between the back and belly; profile very con-

vex. Mouth very small, oblique, the maxillary scarcely reaching the middle of the orbit. Head small, short, about as deep as long. Eye large, as long as snout,  $3\frac{1}{2}$  in head. Gill-rakers shortish, rather strong, 20 below arch; anal spines small, the second longest; upper lobe of the candal falcate, more than a third longer than the lower. Lateral seutes numerous, very strong. Teeth rather strong, in one series in each jaw; teeth on tongue few or none; those on vomer and palatines minute, deciduous; scales small; cheeks naked, breast scaly; lateral line strongly arched, the arch about one-third the straight portion; scaly sheaths of dorsal and anal very high, extending the whole length of fin. Pectoral falcate longer than head, reaching anal. Head  $4\frac{1}{3}$ ; depth  $2\frac{1}{2}$ . D. VII-I, 28; A. II-I, 25; Lat. l. (scutes) about 50. West Indies northward; not common.

(Holbrook, Ichth. S. C. 1860, 94: Caranx amblyrhynchus Gunther, ii, 441, pt. not of C. & V.: Carangons falcatus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 431.)

aa. Teeth unequal; lower jaw with small canines. (Carangus \* Grd.)

### 690. C. fallax C. & V.

Bluish, sides golden or silvery, a very small, black opercular spot. Form of C. hippus, but the profile not so strongly arched. Teeth as in C. hippus. Breast entirely scaly; anterior part of soft dorsal fin black; no spot on the pectorals. Scutes present on whole of straight part of lateral line; arched part of lateral line  $1\frac{2}{3}$  in straight part; an abrupt angle at junction of the two parts. Pectoral shorter than head, maxillary reaching posterior edge of pupil; cheek and upper parts of opercles scaly; scaly sheaths of fins little developed. Head  $3\frac{2}{5}$ ; depth  $2\frac{1}{2}$ . D. VIII-I, 22; A. II-I, 16; Lat. l. 35 (scutes). Warm seas, north to South Carolina; not common.

(Cuv. & Val. ix, 95: Caranx hippos Günther, ii, 449: Caranx richardi Holbr. Ichth. S. C. 1860, 96.)

# 691. C. hippus (L.) Günther.—Crevallé; Horse Crevallé.

Olivaceous above; sides and below silvery or golden; a distinct black blotch on opercle and one on lower rays of pectorals, the latter sometimes wanting; axil of pectoral dusky; anterior edge of dorsals black; upper edge of caudal peduncle dusky. Body oblong, the anterior profile very strongly arched. Head large and deep. Mouth large, low, and nearly horizontal below axis of body; lower jaw included; maxillary extending to nearly opposite posterior border of eye. Teeth in upper

<sup>\*</sup> Girard, U. S. Mex. Bound. Surv. Ichth. 1829, 23; type Scomber carangus Bloch; name a modification of Caranx.

jaw in a broad villiform band; an outer series of large, wide-set, conical teeth; teeth of lower jaw in one row, a distinct canine on each side of symphysis; villiform teeth on vomer, palatines, pterygoids, and tongue. Lateral line with a wide arch, its length  $\frac{3}{4}$  that of straight part; plates not covering all of straight part. Dorsal spines short, rather stout; procumbent spine obsolete. Gill-rakers stout, not very long, 15 below angle. Occipital keel sharp. Eye not very large, longer than snout, 4 in head. Pectoral falcate, longer than head. Breast naked, with a small patch of scales in front of ventrals only. Caudal lobes equal. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; Lat. l. (scutes) about 30. D. VIII-I, 20; A. II-I, 17. Cape Cod to West Indies; common southward.

(Scomber hippos L. Syst. Nat: Carangus hippos Gill, Proc. Acad. Nat. Sci. Phila. 1862, 433: Caranx defensor Holbrook, Ichth. S. C. 1860, 87: Caranx caninus Günther, Trans. Zoöl. Soc. Lond. 1866, 432: Scomber carangus Bloch, taf. 340: Scomber chrysos Mitchill, Trans. Lit. and Phil. Soc. N. Y. i, 424: Carangus chrysos Gill, Proc. Acad. Nat. Sci. Phila. 1862, 434: Carangus esculentus Grd. U. S. Mex. Bound. Surv. Ichth. 23: Caranx carangus Günther, ii, 448.)

### 222.-BLEPHARES Cuvier.

# Cobbler-fishes.

(Gallus Lacépède, preoccupied: Scyris, Hynnis and Gallichthys Cuv. & Val.: Blepharichthys Gill.)

(Cuvier, Règne Anim. ii, 1817: type Zeus ciliaris Bloch.)

Body rhomboid, deep, strongly compressed, more or less completely covered with minute embedded scales, sometimes apparently naked; those on the straight portion of the lateral line enlarged, bony and spinous, as in *Caranx*, but less developed. Mouth moderate, with bands of villiform teeth on jaws, vomer, palatines, and tongue. First dorsal fin little developed, the spines short and rudimentary, mostly disappearing with age; soft dorsal and anal similar to each other; the first five or six rays of each fin elongate and filiform in the young, becoming shorter with age; ventral fins elongate in young; on finlets. Caudal peduncle narrow; the caudal widely forked. Gill-rakers moderate, stout. This genus is not essentially different from *Caranx*. Warm seas. ( $\beta\lambda\varepsilon\varphi a\rho n\varepsilon$ , cilium.)

### 692. B. crimitus (Akerly) Dekay.

Bluish above, golden yellow below; a dark blotch on opercle; a black spot on orbit above; a black blotch on dorsal and anal in front. Body oval, much compressed, highest at the elevated bases of dorsal and anal fins. Preorbital very deep. Mouth nearly horizontal in the

adult, very oblique in the young. First rays of dorsal and anal filamentons, exceedingly long, becoming shorter with age. Lateral line with a wide arch, the curved portion about equal to straight. Scaly sheath of fins little developed. Scates become stronger and blunter with age. Ventrals broad. Occipital keel sharp. Pectorals long and falcate, longer than head. Head 3\frac{1}{3} in length; depth 1\frac{1}{4} to 2. D. VI-I, 19; A. II-I, 16. Scates 12. Cape Cod to South America; not very abundant northwards.

(Zeus crinitus Akerly, Amer. Jour. Sci. xi, 141; Dek. N. Y. Fauna, Fish. 123: Caranx sutor Günther, ii, 454.)

223.—SELENE Lacépède.

# Moon fishes.

(Argyriosus Lacépède: Vomer Cuvier.)

(Lacépède, Hist. Nat. Poiss. iv, 560, 1803: type Selene argentea Lac.)

Body very closely compressed and much elevated, the profile very oblique or nearly vertical; edges of body everywhere trenchant, especially anteriorly. Head short and very deep, the opercle very short, and the preorbital extremely deep; an abrupt angle at the occipital region. Mouth rather small; premaxillaries protractile, fitting into a notch between the bases of the maxillaries; maxillaries broad, each with a supplemental bone. Tongue narrow, free. Teeth minute, on jaws, tongue, vomer, and palatines. Gill-rakers long and slender. Spines of fins usually weak, more or less filamentous in the young; free anal spines immovable, sometimes obsolete in the adult. Soft fins falcate or not. No finlets. Head naked. Scales minute. Lateral line unarmed. Coloration silvery.  $(\sigma z \lambda \dot{\gamma} v_{7}$ , the moon.)

a. Soft dorsal and anal with the anterior rays much produced in the adult. (Selene.)

## 693. S. vomer (L.) Liitken.-Moon-fish; Look Down; Horse-head.

Bluish above, sides and below silvery with golden reflections; anterior edge of soft dorsal black; axil dusky. Diameter of eye, length of opercle, and distance from eye to profile about equal; eye 2 in maxillary,  $2\frac{1}{2}$  in preorbital; mandibles very deep, the dentary bones thin, approximate; one or two of the dorsal spines greatly elongate and filamentous in the young, short in the adult; ventrals variable in length, usually about as long as the eye in the adult, variously elongate in partly grown specimens. Head 3 in length; long dorsal rays 2; pectoral  $2\frac{3}{4}$ ; long anal rays  $2\frac{3}{3}$ ; depth  $1\frac{1}{2}$ . D. VII-I, 22; A. II-I, 20. Warm seas; rather common southward, north to Long Island, and Lower California.

(Zeus vomer Linn, Syst. Nat.: Zeus eapillaris Mitch. Trans. Lit. & Phil. Soc. N. Y.

1815, 383: Argyriosus romer Günther, ii, 458: Selene argentea Lacépède, iv, 560: Argyreiosus paeificus Lockington, Proc. Cal. Acad. Nat. Sci. 1876: Selene argentea (adult) and Argyriosus romer (partly grown) of most recent writers. Lütken, Spolia Atlantica, 1880, 547, in which memoir the stages of growth of this and other species are fully described.)

aa. All the fins very low, none of the rays produced or filamentous in the adult. (Fomer\* Cuvier.)

### 694. S. setipizmis (Mitch.) Lütken.—Horse Fish.

Greenish above, below golden or silvery. Young with a black blotch at origin of straight part of lateral line. Body oblong, rhombie, less elevated than in the other species; profile anteriorly nearly vertical, highest above the eye, snout somewhat protruding, belly most arched in the young; mouth oblique; maxillary reaching vertical from front of orbit. Ventral fins minute; dorsal and anal very low, especially in the adult, the long rays disappearing very early; pectorals falcate, about as long as head. Head 3½ in length; depth 1½. D. VIII-I, 21; A. II-I, 17. Tropical America, north to Cape Cod; not very common on our coasts.

(Zeus setapinnis Mitch. Trans. Lit. & Phil. Soc. N. Y. 1815, 384: Argyreiosus setipinnis Günther, ii, 459: Vomer browni Cuv. & Val. ix, 189: Vomer browni Dekay, New York Fauna, Fish. 127; Lütken, Spolia Atlantica, 1880, 543: Vomer enrus Cepe, Proc. Acad. Nat. Sci. Phila. 1870, 119: Argyreiosus unimaculatus Batchelder.)

#### 224.—CHLOROSCOMBRUS Girard.

(Micropteryx Agassiz, preoccupied.)

(Girard, Proc. Acad. Nat. Sci. Phila, 1858, 168: type Seriola cosmopolita Cnv. & Val. = Scomber chrysurus L.)

Body oblong ovate, closely compressed, but not elevated; the abdomen prominent anteriorly, its curve being much greater than the curve of the back. Occiput and thoracic region trenchant. Caudal peduncle very narrow, the fin widely forked. Scales small, smooth. Lateral line arched in front, unarmed. Head nearly naked. Preorbital low. Mouth rather small, oblique, lower jaw searcely projecting; upper jaw protractile; maxillary broad, emarginate behind, with a large supplemental bone. Jaws, vomer, and palatines with feeble teeth, mostly in single series. First dorsal of feeble spines, connected by membrane; second dorsal and anal long and low, similar, much longer than the short abdomen. No finlets. Anal spines strong. Ventrals small; pectorals falcate. Gill-rakers long.  $(\chi \lambda \omega \rho \sigma_5, \text{ green}; \sigma z \tilde{\sigma} \mu \tilde{J} \rho \sigma_5, \text{ mackerel.})$ 

<sup>\*</sup> Cuvier, Régne Anim. ii, 1817: type Vomer browni Cuv. = Zeus setipinnis Mitchill: (Latin vomer, a plowshare.)

### 695. C. chrysurus (L.) Gill.

Greenish above, sides and below golden; caudal peduncle dusky above; dark operentar and axillary spots; inside of month black. Head rather deeper than long; opercles very short; snout short. Mouth very oblique; maxillary reaching anterior margin of eye; eye very large, longer than snout, about 3 in head. Caudal peduncle longer than deep, its diameter less than that of the eye; ventrals very small, fitting into a groove in which the vent is situated; pectorals long, falcate, one-third the length. Head  $3\frac{3}{4}$  in length; depth  $2\frac{1}{3}$ . D. VIII—I, 26; A. II—I, 26. Cape Cod to Lower California and India; common on our South Atlantic coast.

(Scomber chrysurus Linn. Syst. Nat.: Micropteryx chrysurus Günther, ii, 460: Seriola cosmopolita Cuv. & Val. ix, 219: Seriola chloris Holbrook, Ichth. S. C. 1860, 79: Chloroscombrus caribbaus Grd. Ichth. U. S. Mex. Bound. Surv. 21.)

# 225.—TRACHYNOTUS Lacépède.

## Pompanos.

(Bothrolamus Holbrook: Doliodon Girard.)

(Lacépède, Hist. Nat. Poiss. ii, 1800: type Chatodon glancus Bloch.)

Body compressed, moderately elevated, the general outline ovate. Caudal peduncle short and rather slender. Abdomen not trenchant, shorter than the anal fin. Head moderately compressed, very blunt, the snout abruptly truncate. Mouth nearly horizontal, the maxillary reaching the middle of the eye; premaxillaries protractile; maxillary without distinct supplemental bone. Jaws, vomer, and palatines with bands of villiform teeth, which are decidnous with age. Preopercle entire in the adult. Gill-rakers short. Gill-membranes considerably united. Spinous dorsal represented by six rather low spines, which are connected by membrane in the young and are free in the adult. specimens the spines appear small on account of encroachments of the flesh, and ultimately often disappear. Second dorsal long, elevated in front; anal opposite to it and similar in form and size; two stout, nearly free spines in front of anal, and one connected with the fin, these often disappearing with age. Scales small, smooth. Lateral line unarmed, little arched; no caudal keel. "When extremely young the preoperculum is armed at the angle with three large spines, and smaller ones above and below. The spinous dorsal is developed as a perfect fin, and teeth are present on the jaws and palatine arch. In this stage the species has never been described by previous naturalists, and consequently has received no name, as the corresponding stage of Naucrates (Nauclerus) has. At an early period the preopercular spines are absorbed into the substance of the preoperculum and disappear. The spinous dorsal and the teeth are still retained. In this condition it remains for some time, 'he spinous dorsal, however, gradually losing its relative size, while the soft vertical fins increase. In this stage the species belongs to the genus Doliodon of Girard. At a later period the membrane connecting the dorsal spines has become obsolete, and the species then represents the genus Trachynotus, as understood by Cuvier and Valenciennes, and others. Finally, in old age, the teeth of the jaws, palate, and pharyngeal bones have fallen out, and the lobes of the dorsal, anal, and caudal fins attained their greatest extension and become pointed. This final stage has been made known by Holbrook under the new generic name of Bothrolemus" (Gill, Proc. Acad. Nat. Sci. Phila. 1862, 440). The pseudobranchiæ also disappear in old specimens. The species of Trachynotus are among those most highly valued as food-fishes. (τραγός, rough; νῶτος, back.)

- a. Body without dark bands.
  - b. Vertical fins without black.

### 696. T. carolinus (L.) Gill.-Common Pompano.

Uniform bluish above, sides silvery, golden in the adult, without bands; fins plain silvery or dusky. Body oblong ovate, elevated, profile forming a gentle curve from the middle of the back to the snout, where it descends abruptly. Dorsal and anal falcate, their lobes reaching when depressed nearly to the middle of the fin; pectoral reaching to opposite the vent. Gill-rakers short, slender in the young, becoming thick in the adult. Head 4; depth  $2\frac{1}{3}$ . D. VI-I, 25; A. II—I, 23. L. 18 inches. West Indies, north to Cape Cod; the most valued food-fish of our southern waters.

(Gasterosteus carolinus Linn. Syst. Nat.: Trachynotus pampanus Günther, ii, 484; Bothrolæmus pampanus Holbrook, Ichth. S. C. 1860, 81.)

bb. Vertical fins largely black.

### 697. T. ovatus (L.) Gthr.

Bluish, sides silvery; lobes of the dorsal and anal more or less black. Body comparatively deep. Head about 4. Depth 1\(^3\) to 2. D. VI-I, 19; A. II—I, 18. In all warm seas; north to Virginia on our Atlantic coast.

(Gasterosteus oratus L. Syst. Nat.; Günther, ii, 481.)

### 698. T. goreensis C. & V.

Dorsal, anal, and caudal lobes black. Snout obliquely truncated; maxillary reaching to below the centre of the eye; anterior rays of dor-

sal and anal extending beyond the middle of the fins when depressed. Head  $4\frac{1}{2}$  in total length; depth,  $2\frac{3}{4}$ ; caudal lobes 4. D. VI—I, 20; A. II—I, 17. Florida to Africa. (Günther.) Not evidently different from the preceding.

(Cuy. &. Val. viii, 419; Günther, ii, 483,)

aa. Body with vertical dark bands.

### 699. T. glaueus Cuv. & Val.

Bluish, sides golden, with four narrow blackish vertical bands, the first under the first dorsal spine, the second under the fifth, the others under the soft dorsal. Dorsal and anal fins falcate, much elevated anteriorly, reaching beyond base of caudal; caudal lobes elongate. Head 3\(^3\); depth 2. D. VI-I, 19; A. H-I, 18. Pyloric coca 13. Tropical seas, north to Virginia and Lower California.

(Cuv. & Val. viii, 400; Günther, ii, 483; Holbrook, Ichth. S. C. 192.)

### 226.-NAUCRATES Rafinesque.

Pilot-fishes.

(Nauelerus Cuvier; young.)

(Rafinesque, Caratteri di Aleuni Nuovi Generi, & c., 1810, 44: type Naucrates conductor Raf. == Gasterosteus ductor L.)

This genus differs from *Seriola* only in the reduction of the spinous dorsal to a few (4 or 5) low, unconnected spines. The young (*Nauclerus* Cuv.) have the spines of the dorsals connected by membrane, and a more or less distinct strong spine at the angle of the operculum. A single species, in the open seas. ( $vaozpáz\eta z$ , ruler of the ships, *i. e.* holding ships fast—a name applied by the ancients to *Echencis* and other fishes.)

### 700. N. ductor (Linn.) Raf.—Pilot-fish; Romero.

Bluish, with five to seven dark vertical bars. Body rather elongate, little compressed. Snout rather blunt. Month terminal, oblique, small; maxillary scarcely reaching orbit. Caudal keel large, fleshy; pectorals short and broad; ventrals rather large. Head 4 in length; depth 4. D. IV—I, 26; A. II—I, 16. In all warm seas; occasional on our Atlantic coast.

(Gasterosteus duetor Linn. Syst. Nat.: Nauerates noveboracensis Cuv. & Val. viii, 325; Günther, ii, 374.)

### 227.-SERIOLA Cuvier.

Amber-fishes.

(Halatractus Gill.)

(Cuvier, Règne Anim. ed. 2, ii, 1829: type Caranx dumerili Risso.)

Body oblong, moderately compressed, not elevated. Occiput and breast not trenchant. Head usually more or less conical, not very blunt. Mouth comparatively large, with broad bands of villiform teeth on both jaws, tongue, vomer, and palatines; a broad, strong, supplemental maxilillary bone; premaxillaries protractile. Scales small. Lateral line scarcely arched, forming a keel on the caudal peduncle, not armed with bony plates. Sides of head with scales. First dorsal with about seven low spines, connected by membrane; second dorsal very long, elevated in front; anal similar to the soft dorsal but not nearly so long, shorter than the abdomen, preceded by two very small free spines, which disappear in old fishes; no finlets; ventral fins very long; pectorals short and broad. Gill-rakers moderate. Species of moderate or large size, often gracefully colored; most of them valued as food-fishes. This genus should probably be united to Naucrates. (Seriola, the Italian name of S. dumerili.)

### 701. S. Jalandi Cuy, & Val.—Yellow-tail.

Bright steel-blue above, sides dull silvery, an irregular yellowish lateral band; fins dusky yellowish green; caudal dull yellow. Body regularly fusiform, somewhat compressed, tapering to the sharp snout and slender caudal peduncle. Maxillary reaching front of pupil. Mouth not very large. Gill-rakers long and strong. Head naked, except on the cheeks. Fins scaleless. Caudal keel moderate; caudal lobes nearly equal. Spines of moderate development, the free anal spines disappearing with age. Pectorals shorter than ventrals, which are half length of head; longest dorsal ray  $\frac{2}{5}$  height of body. Pyloric exceavery numerous. Head 4; depth 4. D. V to VII-I, 35; A. II-I, 21. L. 3 feet. In most warm seas; abundant in summer about the Santa Barbara Islands; also occasional on the South Atlantic coast. An excellent food-fish.

(Cuv. & Val. ix, 208, 1833; Günther, ii, 463: Seriola aureovittata Schlegel, Faun. Japan. Poiss. 115, pl. 62.)

## 702. S. rivoliana Cuv. & Val.—Rock Salmon.

Color uniform; an oblique black band from the nape through the eye to the preorbital. Snout conical, 1½ times the diameter of the eye. Maxillary not reaching the vertical from centre of pupil. Back, neck, and

abdomen slightly compressed. Ventrals reaching vent; soft dorsal falcate, its height 6 in length. Scales small. Depth 3; head 4. D. VII, I, 29; A. II, I, 21; Lat. l. about 131. (Günther.) Coast of Brazil to Florida.

(Cuv. & Val. ix, 207: Seriola bonariensis Günther, ii, 434: Seriola bonariensis Goode & Bean, Proc. U. S. Nat. Mus. ii, 1879, 129: ? Seriola bosci \* Cuv. & Val. ix, 209: Lütken, Spolia Atlantica, 1880, 603: Seriola falcata Günther, ii, 464.)

### 703. S. stearnsii Goode & Bean.

Color bluish above, whitish beneath, a band of greenish yellow as wide as the eye extending from the preopercle to the extremity of the tail; fins greenish; traces of bands on the opercle. Body subfusiform, highest at origin of second dorsal, thence tapering evenly to snout and tail. Candal peduncle somewhat depressed, with lateral carine and strong transverse grooves above and below; maxillary reaching vertical from middle of orbit. Teeth villiform in jaws, on vomer, palatines, and in one median and two lateral series on tongue. Scales small on the cheeks, none on limb of preopercle or the remainder of the head. Head  $3\frac{1}{2}$  in length; depth  $4\frac{2}{3}$ . Eye  $6\frac{1}{3}$  in head. D. VII-I, 36; A. II-I, 19. (Goode & Bean.) Gulf of Mexico, north to Pensacola.

(Goode & Bean, U. S. Nat. Mus. 1879, 48.)

## 701. S. zonata (Mitch.) C. & V.—Rudder Fish.

Bluish above, white below; sides with about 6 broad black bars, the forming three large blotches on the dorsal and two on the anal; the bars growing faint or disappearing with age; an oblique dark band from the spinous dorsal to the eye, the space above this olivaceous; spinous dorsal black; ventrals mostly black. Head longer than deep; profile descending in a gentle curve; top of head to base of dorsal fin compressed. Mouth nearly horizontal; maxillary reaching to below the middle of orbit. Pectorals small, rounded, as long as the eye and snout; ventrals two-thirds length of head. Vent behind middle of body. Head  $3\frac{1}{2}$  in length; depth,  $3\frac{1}{3}$ . D. VII-I, 38; A. II-I, 21. L. 30 inches. Cape Cod to Florida; rather common.

(Scomber zonatus Mitch. Trans. Lit. and Phil. Soc. N. Y. 1815, 427; Günther, ii, 465: Seriola carolinensis Holb. Ichth. S. C. 1860, 72; from South Carolina, wants the vertical bands, but is not otherwise obviously different; this is doubtless due to increased age, as Holbrook's type was over two feet in length.)

### 705. S. fasciata (Bloch) Cav. & Val.

Greenish above, yellow below; body with sixteen narrow and somewhat irregular brown cross-bands, arranged in pairs; those between

<sup>\*</sup>Body deeper, eye larger, spines stouter, and caudal broader than in S. dumerili. D. VII-I, 31; A. II-I, 20. Silvery with a brown temporal band. South Carolina. (Cuv. & Val.)

the soft dorsal and anal extend on those fins, forming five blotches on the former and three on the latter; a blackish band between the eyes; ventrals black. Head short, deeper than long; profile convex. Dorsal and anal fins not elevated. D. VII-I, 30; A. II, 20. (Cur. & Val.) Coast of South Carolina.

(Scomber fasciatus Bloch, Ichth. taf. 341; Günther, ii, 464; Cnv. & Val. ix, 211: Zonichthys\* fasciatus Swainson, Class. Fish. 1839, 248.)

### 228.-ELAGATIS Bennett.

### Yellow Tails.

(Seriolichthys Bleeker: Decaptus Poey.)

(Bennett, Narrative of a whaling voyage, ii, 283, 1840: type Seriola bipinnulata, Qaoy & Gaimard.)

Second dorsal and anal long, each with one detached finlet composed of two rays. Otherwise as in Seriola. (ἡλἄκάτη, a spindle.)

### 706. E. pinmulatus Poey.

Bluish, with two longitudinal bluish bands, yellowish below. Body fusiform, very elongate. Cheeks scaly. Maxillary reaching a little beyond nostrils. Eyes  $7\frac{1}{2}$  in head. Caudal keel feeble; caudal lobes very long. Pectorals pointed, halfas long as head. Fins not scaly. Two rays connected by membrane in each finlet. Head  $4\frac{3}{4}$ ; depth  $5\frac{1}{2}$ . D. VI–I, 26–II; A. II–I, 17–II. L.  $2\frac{1}{2}$  feet. (*Poey.*) West Indies, north to Florida; rare.

(Seriola pinnulata Poey, Memorias, ii, 233, 1858.)

# 229.—SCOMBROIDES Lacépède.

### Leather-jackets.

(Lacépède, Hist. Nat. Poiss. iii, 52, 1802: type Scomberoides noeli Lac.)

Body compressed, oblong or lanceolate. Caudal peduncle slender, not keeled. Head short, compressed, acute. Occipital keel sharp. Mouth rather large, with small sharp teeth in bands on jaws, tongue, vomer, and palatines, and sometimes on the pterygoids. Jaws about equal, the upper not protractile; maxillary very narrow, without distinct supplemental bone. Gill-rakers rather long. Scales small in our species, linear, and extremely narrow, embedded in the skin at different angles. Lateralline unarmed. Dorsal spines rather strong, 3 to 7 in number, nearly free in the adult; second dorsal very long, its posterior rays pencillated and nearly or quite disconnected, forming finlets; anal

<sup>\*</sup> The genus Zonichthys Swainson, l. c., based on this species is characterized by the deep head, its depth at the occiput being greater than its length. ( $\zeta o \nu o s$ , zone;  $i \chi \theta \dot{\nu} s$ , fish.)

rather longer than soft dorsal, much longer than the abdomen, its last rays forming similar finlets; anal spines strong; ventral fins depressible in a groove; pectoral fins very short. Species numerous in the tropical seas. The American species belong to the subgenus or genus Oligoplites, characterized by the toothless pterygoids and the peculiar scales. The dorsal spines are seven in Scombroides proper (Chorinemus Cnvier), the pterygoids are armed with teeth, and in most of the species the scales are normally developed. (5209,3905, mackerel; \$1605, like.)

a. No pterygoid teeth; scales linear, embedded (Oligoplites \* Gill.)

## 707. S. occidentalis (Linn.) J. & G.-Leather-jacket.

Bluish above, bright silvery below; fins yellow. Body lanceolate, slender. Eye as long as snout, about 4 in head; opercles short. Maxillary reaching beyond middle of orbit. Scales very long and narrow, embedded in the skin, placed obliquely at angles with each other, their appearance unlikeordinary scales. Fins low; pectoral as long as eye and snout; caudal very deeply forked, the lobes equal. Head 5 in length; depth 4. D. V, I,20; A. II—I, 20. Both coasts of Central America, and West Indies, north to New York and Lower California; not rare southward.

(Gasterosteus occidentalis Linn. Syst. Nat.: Chorinemus occidentalis Giinther, ii, 475; Oligophites occidentalis Gill, Proc. Acad. Nat. Sci. Phila. 1863, 166.)

# FAMILY LXXVI.—POMATOMIDÆ.

(The Blue-fishes.)

Body oblong, compressed, covered with rather small scales, which are weakly etenoid. Caudal pedancle rather stout. Head large, compressed. Mouth large, oblique. Premaxillaries protractile. Maxillary not slipping under the preorbital, provided with a large supplemental bone; lower jaw projecting; bands of villiform teeth on vomer and palatines, those on the vomer forming a triangular patch; jaws each with a single series of very strong, compressed, unequal teeth, widely set; upper paw with an inner series of small depressed teeth; villiform teeth on the base of the tongue. Occipital keel strong; free edge of preopercle produced and serrated. Gill-membranes free from the isthmus, not united. Branchiostegals 7; gills 4, a slit behind the fourth. Pseudobranchiæ large. Gill-rakers slender, rather few. Opercle ending in a flat point. Cheeks and opercles scaly. Lateral line present, unarmed. Dorsal

<sup>\*</sup>Gill. Proc. Acad. Nat. Sci. Phila. 1863, 166: type Gasterosteus occidentalis L. (oliyos, few;  $\dot{o}\pi\lambda i r\eta s$ , armed.)

fins 2, the anterior of about 8 weak, low spines, connected by membrane and depressible in a groove; second dorsal long, similar to the elongate anal, both fins being densely scaly; fin-rays slender. Two very small, free, anal spines, sometimes hidden in the skin. Ventrals thoracie, I, 5. Pectorals rather short. Caudal fin forked, the lobes broad. Air-bladder simple, with thin walls. Pyloric execa very numerous. Vertebrae 10+14, as in Carangidæ. A single species, found in nearly all warm seas. This family is closely related to the Carangidæ, from which group it is an offshoot toward the Perceids.

(Carangida, genus Temnodon Günther, ii, 479-480.)

### 230.—POMATOMUS Lacépède.

## Blue-fish.

(Temnodon Cuvier.)

(Lacépède, Hist. Nat. Poiss. iv, 436, 1802: type Pomatomus skib Lac. = Gasterosteus saltatrix L.)

Characters of the genus included above.  $(\pi\tilde{\omega}\mu\alpha, \text{ operculum}; \tau\sigma\mu\delta\varsigma, \text{ cutting}; \text{ from the serrated preopercle.})$ 

708. P. saltator (L.) Gill.—Blue-fish; Green-fish; Skip-jack.

Bluish or greenish, silvery below; a black blotch at base of pectoral. Body robust, moderately compressed; belly compressed to a bluntish edge. Head deep; top of head and a ridge on each side above the cheeks naked. Cheeks much longer than the opercles. Pectorals placed rather low, their length a little more than half that of the head. Head 3\frac{1}{3}; depth 4. D. VIII-I, 25; A. II-I, 26; Lat. l. 95. L. 3 feet. Atlantic and Indian Oceans; of late years very abundant on our Atlantic coast; a large, voracious fish, extremely destructive to other fishes; valued for food.

(Perca saltatrix L. Syst. Nat. xi, 1760, i, 293: Gasterostcus saltatrix L. Syst. Nat. xii, 1766: Temnodon saltator Cuv. & Val. ix, 225: Temnodon saltator Storer, Hist. Fish. Mass. 360: Temnodon saltator Günther, ii, 479.)

# Family LXXVI (b).—NOMEIDÆ.

## (The Nomeids.)

Seembroid fishes with the body oblong, more or less compressed, covered with cycloid scales of moderate size. Vertebræ more than 10+14, as in *Scombridæ* and *Stromatcidæ*. Mouth large or small, usually with minute teeth; premaxillaries protractile; maxillary narrow. Gill-membranes separate, free from the isthmus; pseudobranchiæ large. No tooth-like processes in the æsophagus. Preopercle entire, or crenu-

late. Lateral line unarmed. Ventrals thoracic, I, 5, sometimes depressible in a deep groove in the abdomen. Dorsal fins separate; the spines usually feeble, connected by membrane. Soft dorsal long, sometimes with finlets; anal fin similar to soft dorsal, without free spines; caudal peduncle slender, the fin widely forked. Pyloric ereca numerous. Genera 5; species about 10. Fishes of the tropical seas.

(Scombridge, group Nomeina Günther, ii, 387-392.)

a. Cleft of mouth narrow; ventrals received in a deep groove in the abdomen.

Nomeus, 231.

### 231.-NOMEUS Cuvier.

(Cuvier, Règne Anim. 1817: type Gobius groporii Gmelin.)

Body oblong, rather compressed, covered with rather small cycloid scales. Head flattish above; occipital crest little developed; cleft of the mouth narrow. Teeth small, in a single series in the jaws; teeth on the vomer and palatines. Pseudobranchiæ large. First dorsal with 10 or 11 spines; second dorsal and anal very long, similar to each other, without finlets; anal fin with 3 rather strong spines, none of them free; caudal fin not deeply forked; ventral fins long and broad, attached to the belly by a membrane, depressible in a deep furrow in the abdomen. Lateral line running high. Air-bladder present. Pyloric carea very numerous. Vertebræ 16 + 25. Warm seas. (20 $\mu z b z$ , pastor; early travellers having compared the fish to a mullet, herder or berger in Dutch.)

## 709. N. gronovii (Gmel.) Gthr.

Brownish above, silvery below, the sides below with large round brown spots; ventrals black, with silvery edgings; anal with 3 brown spots. Maxillary reaching to below the front of the eye; ventrals reaching front of anal, pectorals still further. D. X-I, 26; A. III, 26. Tropical parts of the Atlantic and Indian Oceans; north to Florida.

(Gobins gronovii Gmelin, Syst. Nat. 1783, 1205: Nomeus mauritii Cuv. & Val. ix, 243: Günther, ii, 387.)

# FAMILY LXXVII.—STROMATEIDÆ.

(The Broad Shiners.)

Scombroid fishes, with the body compressed and more or less elevated, covered with small or minute cycloid scales. Profile anteriorly blunt and rounded. Mouth small. Premaxillaries protractile or not. Dentition feeble; no teeth on vomer or palatines; esophagus armed

Bull. Nat. Mus. No. 16-29

with numerous horny, barbed or hooked teeth. Gills 4, a slit behind the fourth. Gill-membranes either free or more or less joined to the isthmus. Gill-rakers rather long. Pseudobranchiæ present. Cheeks scaly. Preopercle entire or serrate. Lateral line well developed. Dorsal fin single, long, with the spines few or weak, often obsolete; anal fin long, similar to the soft dorsal, usually with three small spines, which are often depressible in a fold of skin; ventrals thoracic or jugular, normally I, 5, but sometimes reduced or altogether wanting; caudal fin lunate or forked. Usually no air-bladder. Pyloric cæca commonly numerous Vertebræ more than 10 + 14. Genera about 5; species 25–30. Small fishes, found in most warm seas. The two subfamilies, both represented in our waters, differ widely from each other in general appearance, but agree in the singular character of teeth in the æsophagus.

(Scombride and Carangide, pt. Günther, ii, 397-404, 485. Genera Stromateus, Centrolophus, and Pammelas.)

- \* Ventral fins minute or absent; opercular bones entire; seales minute; caudal fin forked; premaxillaries not protractile. (Stromateina.)
  - a. Caudal peduncle not keeled; gill-membranes free from the isthmus.

STROMATEUS, 232.

- \*\* Ventral fins well developed; V. I, 5; scales moderate; premaxillaries protractile; caudal lunate. (Centrolophinæ.)
  - b. Dorsal spines short and stout; preopercle, interopercle, and subopercle finely serrate.

    Likus, 233.

### 232.—STROMATEUS Linnaus.

### Harrest Fishes.

(Penrilus and Rhombus Cuvier: Poronotus Gill.)

(Artedi; Linnæus, Syst. Nat.: type Stromateus fiatola L.)

Body ovate or suborbicular, strongly compressed, tapering into a slender caudal peduncle, which is not keeled or shielded. Head short, compressed, the profile obtuse. Mouth small, terminal, the jaws subequal. Premaxillaries not protractile. Jaws each with a single series of weak teeth. Scales very small, cycloid, silvery, loosely inserted, extending on the vertical fins. Opercular bones entire. Gill-membranes separate, free from the isthmus; gill-rakers moderate. Lateral line continuous, concurrent with the back. Dorsal fin long, more or less elevated in front, preceded by a few indistinct spines—usually one or more procumbent spines in front of dorsal and anal, each of these with a free point both anteriorly and posteriorly; anal fin similar to dorsal, or shorter, usually with three small spines; ventral fins wanting in the adult, a rudiment sometimes visible in the young; a single small,

sharp spine, attached to the public bone, often occupying the place of the ventrals; pectorals long and narrow. Caudal widely forked. Species numerous. (στρῶματεος, an ancient name of some brightly colored fish in the Red Sea; from στρῶμα, a bed-quilt.)

- a. Ventral fins obsolete; pelvic spine present.
  - b. Dorsal and anal fins falcate, their anterior rays much longer than the head; body suborbicular. (Rhombus\* Lacépède.)

# 710. S. alepidotus (L.) J. & G.—Harrest Fish.

Greenish above, golden-yellow below. Body suborbicular, bounded by even curves. Mouth very small, oblique, maxillary reaching front of orbit. No pores along the sides of the back. Pectorals shorter than head, reaching half way to caudal; soft dorsal and anal fins falcate, the longest rays of anal nearly half length of body; caudal lobes equal Scales thin and deciduous, not very small. Head 3; depth 1½. D. 45; A. 40; Lat. l. about 90. Vertebra 15+15. Cape Cod to South America; commonest southward.

(Chwtodon alepidotus L. Syst. Nat.: Sternoptyx gardenii Bl. & Schn. 1801, 494; Rhombus longipinnis Cuy. & Val. ix, 401; Stromateus gardenii Günther, ii, 399.)

- bb. Dorsal and anal fins not falcate, their anterior rays shorter than the head; form ovate.
  - c. No series of large pores along the sides of the back.

## 711. S. Simminginanos Ayres.—California Pompano.

Bluish above, brightly silvery below; fins punctulate; anterior lobes of dorsal and anal dusky-edged. Body ovate, blunt anteriorly, with a short, slender tail, the caudal fin widely forked. Month very small, terminal, the maxillary extending to the eye. Teeth very feeble. Gill-rakers short, slender, less than half diameter of eye. Eye small. One or 2 procumbent spines before the dersal; longest rays of dorsal \(^3\) of head; pubic spine small; pectorals longer than head; no pores along base of dorsal. Spines of dorsal and anal very small or entirely obsolete. Scales small, silvery, deciduous. Head 4; depth 2. D. 111, 46; A.III, 40. L. 10 inches. Pacific coast of United States; abundant in summer; highly prized as a food-fish.

(Poronotus simillimus Ayres, Proc. Cal. Acad. Nat. Sci. 1830, 84.)

cc. A series of large pores along the base of the dorsal fin. (Poronotus† Gill.)

712. S. trincanthus Peck.—Dollar-fish; Harvest-fish; Butter-fish; La Fagette.

Bluish above, below silvery. Body oval, much compressed. Dorsal

<sup>\*</sup> Lacépède, Hist. Nat. Poiss. ii, 321, 1800: type Chwlodou alepidotus L.  $(\dot{\rho}ou\betao\varepsilon, rhomb.)$ 

<sup>†</sup>Gill, Cat. Fish. East Coast N. Am. 1861, 35 (not characterized): type Stromutcus triacanthus Peck. ( $\pi o \rho \delta \varepsilon$ , pore;  $\nu \delta \tau o \varepsilon$ , back.)

and ventral outlines about equally curved. Snout very blunt, rounded in profile. Mouth small, the maxillary not reaching the orbit. Caudal peduncle very short; anterior rays of dorsal and anal little elevated. Lateral line high, a series of conspicuous pores above it near the base of the dorsal. Pectorals much longer than head. Gill-rakers rather long,  $\frac{2}{3}$  diameter of the eye, which is 4 in head. Head 4; depth  $2\frac{1}{3}$ . D. III, 45; A. III, 38. L. 10 inches. Maine to Cape Hatteras; very abundant.

(Peck, Mem. Amer. Acad. ii, 48: Rhombus eryptosus Cuv. & Val. ix, 408; Günther, ii, 398.)

### 233.-LIRUS Lowe.

## Rudder-fishes.

(Palinurus DeKay, preoccupied in Crustacea: Palinurichthys Gill: Pammelas Günther.)
 (Leirus Lowe, Proc. Zoöl. Soc. Lond. 1839, 82: type Leirus bennetti Lowe = Centrolophus ovalis C. & V.)

Body ovate, compressed, more elongate and less compressed than in Stromateus. Profile very blunt and convex. Mouth moderate; maxillary narrow, with a small supplemental bone; premaxillaries protractile, little movable. Jaws nearly equal, each with about one series of small, slender teeth: no teeth on vomer or palatines. Preoperculum. interoperculum, and suboperculum finely serrated. Gill-rakers long; gill-membranes separate, free from the isthmus. Scales small, smooth; larger, thicker, and more adherent than in Stromateus. Cheeks sealy. Fins rather low; dorsal fin long, preceded by 6-8 short but rather strong spines, the last ones connected by membrane, the others nearly free; anal fin similar but shorter, preceded by 3 spines, which, like the dorsal spines, are nearly imbedded in thick skin; vertical fins densely scaly towards their bases; caudal fin emarginate; caudal peduncle stout; ventral fins large, thoracic, I, 5; pectoral fins moderate, rounded or falcate. Two species, differing from the European genus Centrolophus chiefly in the development of the dorsal spines, which in the latter genus are indistinguishable from the soft rays. (λειρος, thin.)

### 713. L. perciformis (Mitch.) J. & G.—Rudder-fish.

Blackish green, everywhere dark, the belly scarcely paler and not silvery. Eye rather large, with an adipose eyelid, its diameter nearly equal to the snout,  $4\frac{1}{2}$  in head. Maxillary reaching to opposite front of pupil. Top of head naked, covered with small mucous pores. Pectorals nearly as long as head. Head  $3\frac{1}{3}$ ; depth  $2\frac{1}{2}$ . D. VII, I, 21; A.

HI, 16; Lat. l. 75. L. 1 foot. Maine to Cape Hatteras; rather common northward.

(Coryphevaa perciformis Mitch. Amer. Month. Mag. ii, 1818, 244: Palinurus perciformis DeKay, New York Fauna, Fish. 1842, 118: Palinurichthys perciformis Gill, Proc. Acad. Nat. Sci. Phila. 1860: Panmelas perciformis Günther, ii, 485.)

# FAMILY LXXVIII.—LAMPRIDIDÆ.

(The Opahs.)

Body ovate, compressed, and elevated, covered with minute, very decidnous, eyeloid scales. Head small, rather pointed. Month small. terminal, without teeth, its angle with slits in the skin to permit the motion of the jaws, as in Orcurus. Premaxillaries protractile. Operenlar bones entire. Dorsal fin single, very long, elevated, and falcate in front, without distinct spines; anal long and low, not at all falcate; both fins depressible in a groove; ventral fins thoracic, but behind the pectorals, composed of 14 to 17 rays; pectoral fins large, falcate, their bases horizontal; caudal fin moderately forked, its peduncle short and slender, without keel. Lateral line present, much arched in front. Branchiostegals 6. Gill-membranes free from the isthmus. Œsophagus not armed with spinous teeth. Air-bladder large, bifurcate behind. Pyloric appendages very numerous. Vertebræ 45. Fishes of large size and gorgeous coloration, inhabiting the open Atlantic. A single genus with one or two species.

(Scombridae, genus Lampris, Günther ii, 415, 416.)

### 234.-LAMPRIS Retzius.

## Opahs.

(Retzius, Nya Handlung, iii, 91, 1799: type  $\it Zeus$   $\it guttatus$  Brünnich =  $\it Zeus$   $\it luna$  Gmelin.)

Characters of the genus included above. ( $\lambda \alpha \mu \pi \rho \delta \varsigma$ , radiant.)

### 714. L. guttatus (Brünnich) Retz .- Opah; King-fish; Sun-fish.

Color a rich brocade of silver and lilae, rosy on the belly; everywhere with round silvery spots; head, opercles and back with ultramarine tints, jaws and fins vermilion; flesh red. Longest dorsal ray shorter than pectorals, which are nearly as long as the head. Anal very low in front, a little higher behind. Head  $3\frac{1}{4}$ ; depth  $1\frac{3}{4}$ . D. 54; A. 40; V. 14-17. Vert. 23+22. L. 3-4 feet. (*Lowe.*) Atlantic, occasional off Newfoundland. One of the most gorgeously colored of fishes.

(Zeus guttatus Brünnich, Danske. Selsk. Skr. iii, 1788, 398; Zeus luna Gmelin, Syst. Nat. 1788, 1225; Lampris luna Günther, ii, 416; Cuv. & Val. x, 39; Lampris lauta Lowe, Fish. Madeira, 27.)

# FAMILY LXXIX.—CORYPHÆNIDÆ.

(The Dolphins.)

Body elongate, compressed, covered with small eveloid scales. Cleft of the mouth wide, oblique, the lower jaw projecting. Cardiform teeth in the jaws and on the vomer and palatine bones; a patch of villiform teeth on the tongue; no teeth on the esophagus. Opercular bones Skull with a crest, which is much more elevated in the adult than in the young. A single, many-rayed dorsal fin, not greatly elevated. extending from the nape nearly to the caudal fin; anal similar, but shorter; both without distinct spines; pectoral fins very short and small; ventrals well developed, thoracie, I, 5, partly received into a groove in the abdomen; candal fin widely forked. Lateral line present. Gill-membranes free from the isthmus. Branchiostegals 7; no pseudobranchiæ. No air-bladder.' Pylorie appendages very numerous. Vertebræ more than 10+14. A single genus, with six or eight species. Very large fishes, inhabiting the high seas in warm regions, noted for their brilliant and changeable colors. To this family belongs the Dolphin or Dorade of the ancients, Coryphana hippurus L.

(Scombrida: genus Coryphana Günther, ii, 404-408.)

## 235. CORYPHÆNA Linnæus.

Dolphins.

(Lampugus C. & V.; young or crestless forms.)

(Linnæus, Syst. Nat.: type Coryphana hippurus L.)

Characters of the genus included above. The species are not well known, having been unduly multiplied by authors. (zορόφαινα, the name applied by Aristotle to Coryphæna hippurus, from zόρος, helmet; φαίνω, to show.)

## 715. C. punctulata (Cuv. and Val.) Gthr.—Spotted Dolphin.

Sea-green, silvery below, with scattered black spots on the sides and back; a series of distant rounded spots along the base of the dorsal fin; head with brown stripes. Body elongate, compressed, tapering gently backwards; profile very convex, snout blunt. Mouth large, oblique; maxillary reaching middle of orbit. Pectorals short, falcate; ventrals long and rather narrow. Eye large, nearly as long as snout. Head 4½; depth about 5. "D. 51; A. 25." Warmer parts of the Atlantie, occasional on our coast.

(Lampugus punctulatus Cuv. and Val. ix, 327: Günther, ii, 408: ? Coryphwna equiscti L. Syst. Nat.)

## 716. C. sneuri Cav. & Val.

This species appears to differ from the preceding in the increased number of fin rays. The elevated crest represented in DeKay's figure of his "C. globiceps" is a character of very old individuals. "D. 64; A. 26." (Cur. d. Val.) "D. 63; A. 29." (DeKay.) Atlantic coasts of the United States: rare.

(Cuy, & Val. ix, 302: Coruphwna globiceps DeKay, New York Fauna, Fish. 1842, 132.)

# FAMILY LXXX.—BRAMIDÆ.

(The Bramoids.)

Body oblong or elevated, compressed, covered with cycloid or spinous scales. Month wide, oblique; the jaws, vomer, and palatines provided with small teeth. Premaxillaries protractile. Snont more or less obtuse and convex. Dorsal and anal fins very long, both more or less elevated; ventrals thoracic or jugular, the number of rays usually not 1, 5. Branchiostegals 7. Pseudobranchiæ present. Pylorie appendages few. Vertebræ more than 10+14. Genera 4; species about 10, inhabiting the open seas.

(Scombrida: genera Brama, Taractes, and Pteraclis Günther, ii, 408-411.)

\* Dorsal tin very high, extending from the forehead to the caudal fin, composed of very slender, inarticulate spines; anal fin similar; ventral fins jugular. (Pteraelina.)

a. Jaws, vomer, and palatines with small teeth; air-bladder very small.

Pteraclis, 236.

### 236.-PTERACLIS Gronovius.

(Gronovius, Act. Helvet. vii, 44, 1772: type Coryphana velifera Pallas.)

Body compressed, oblong, covered with moderate-sized cycloid, lobate or emarginate scales. Eye large. Dorsal fin very much clevated, extending from the forehead to the base of the caudal, composed of filiform spines, its form triangular, its base scarcely less than the total length of the fish; anal fin similar in form, also composed of slender fragile spines; ventrals jugular, nearly under the eye, long, of 4–6 slender rays. Pseudobranchiæ present. Air-bladder very small. Most of the species of this singular genus inhabit the Indian Ocean.  $(\pi\tau\epsilon\rho\delta\nu,$  fin or wing;  $2\lambda\epsilon i\omega$ , to close. "The name indicating the double rows of scales which embrace the bases of the two vertical fins.")

### 717. P. carolinus Cuv. & Val.

Silvery, with bluish reflections. Mouth larger, scales larger, and fourth ray of the dorsal stouter than in other species. D. L11; A. LXIV.

Coast of South Carolina; known only from a mutilated specimen 4 inches long, evidently the young of some pelagic species.

(Cuv. & Val. ix, 368; Günther, ii, 411.)

# FAMILY LXXXI.—ZENIDÆ.

(The Dories.)

Body short, deep, much compressed and elevated, naked, or covered with minute scales, or with bony protuberances. Teeth small, in narrow bands or single series, on the jaws and vomer and sometimes on the palatines. Mouth rather large, terminal, the upper jaw protractile. Eyes lateral. Opercles and other bones about the head often armed with spines. Branchiostegals 7 or 8. Gill-membranes little united, free from the isthmus. Pseudobranchiæ large. Air-bladder large. Gill-rakers usually short. Gills 4, a slit behind the fourth. Dorsal fin emarginate, or divided, the anterior part with strong spines, the posterior part longer; anal fin with or without spines; ventral fins thoracie, their rays I, 5 to I, 8; caudal fin usually not forked. Lateral line obscure, unarmed. Pyloric cœca exceedingly numerous. Vertebræ about 32. Genera 5; species about 10; fishes of singular appearance, inhabiting warm seas.

(Scombridae, group Cyttina, Günther, ii, 393–396: Cyttidae Günther, Intr. Study Fish. 450.)

a. Scales minute or wanting; anal spines very strong; no palatine teeth. (Zeninæ.)
 b. Anal spines 3; bases of both dorsals armed with spinous plates. ZENOPSIS, 237.

### 237.—ZENOPSIS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1832, 123: type Zeus nebulosus Temminck & Schlegel, from Japan.)

Body ovate, much compressed, without scales, not warty. Head deeper than long, its anterior profile steep. Mouth rather large, upper jaw protractile; teeth small, on jaws and vomer, none on the palatines. Various bones of the head and shoulder girdle armed with spines. Series of bony plates along the sides of the belly and the bases of the dorsal and anal, each plate armed with a strong spine. Eye large, placed high. Gill-rakers short. Dorsal spines very strong, usually 10 in number. Anal spines 3. Ventral fins long, mostly I, 7. Caudal pedancle slender, the fin not forked. Two or three species known, differing from Zeus, mainly in the presence of 3 anal spines instead of 4. Pelagie. ( $\xi \epsilon \dot{\nu} \xi$ , Zeus;  $\omega \psi \iota \xi$ , appearance. Zeus is from  $\xi \epsilon \dot{\nu} \xi$ , Jupiter.)

## 718. Z. ocellatus (Storer) Gill.

Color silvery, nearly plain: a black lateral ocellated spot in life, disappearing in spirits. Body short, deep, compressed. Skin wholly naked, except for the bony bucklers, which are armed each with a central spine hooked backwards and marked with radiating ridges; 7 bucklers along the base of the dorsal, the 5th and 6th largest; 2 on the median line in front of the ventrals, the second largest; one median plate, and 6 pairs between ventrals and anal, and 4 along the base of the anal. Top of the head with roughish ridges, but without spines; a spine at the base of each dentary bone; the broad maxillaries each with a supplemental bone: teeth nearly obsolete. Eve large, much nearer the gill opening than the tip of the snout. Gill-rakers short. Caudal peduncle very slender, the caudal fin short and rounded; pectorals very short; ventrals large, the rays I, 6, the first soft ray closely appressed to the spine; anal spines short and stout, the soft rays, like those of the dorsal, low; dorsal spines filamentous. D. IX, 26; A. III, 24. Pelagie; one specimen taken at Provincetown, Mass. (Description from the original type.)

(Zeus occilatus Storer, Proc. Bos. Soc. Nat. Hist. vi, 888; Gill, I. c.)

# FAMILY LXXXII.—BERYCIDÆ.

(The Squirrel-fishes.)

Body oblong or ovate, compressed, covered with very strongly etenoid or spinous scales. Head with large muciferous cavities, covered by thin skin. Eye tateral, usually large. Mouth more or less oblique. Premaxillaries protractile; maxillary rather large, usually with a supplemental bone. Bands of villiform teeth on jaws, and usually on vomer and palatines. Opercular bones usually spinous; frequently every membrane bone of the head strongly serrated. Branchiostegals mostly 8. Gill-membranes separate, free from the isthmus. Gills 4, a slit behind the fourth. Pseudobranchiae present. Gill-rakers moderate. Cheeks and opercles scaly. No barbels. Dorsal fin long or short, usually with strong spines; anal with 2-4 spines; ventral fins thoracic, usually 1, 7, the number of rays greater than 1,5; caudal fin usually forked. Pyloric ecca numerous. Genera 5-6; species about 50. Rough-scaled and brightly colored fishes of the warm seas; two species straying to our

coast. Many of them inhabit considerable depths in the ocean. The young often differ widely in appearance from the adult.

(Berycidæ Günther, i, 8-50; exclusive of certain genera.)

a. Dorsal fin continuous, the spinous part short; anal spines 3; abdomen serrated. Hoplostethus, 238,

aa. Dorsal fin deeply emarginate, the spinous part long: anal spines 4.

Holocentrus, 220.

### 238.—HOPLOSTETHUS Cuy, & Val.

(Cavier & Valenciennes, Hist, Nat. Poiss, iv. 469, 1829: type Hoplostethus mediterraneus Cuy, & Val.)

Body short and deep, much compressed. Head short, compressed. very blunt anteriorly, deeper than long, with very conspicuous mucous cavities. Eye very large. Mouth very oblique, the jaws equal when the mouth is closed. Maxillary long, broad behind, with a distinct supplemental bone, which reaches the posterior border of the eye. Teeth very fine, villiform, on jaws and palatines, none on the vomer. orbital with radiating ridges and a few spines; a vertical ridge on the front of the opercle. Opercle little developed, its spine small or obsolete; a strong spine at the angle of the preopercle: the long vertical limb of the preopercle finely serrated. Gill-membranes separate, free from the isthmus. Branchiostegals 8. Scales moderate or small. etenoid; lateral line present, its scales enlarged; abdomen with a series of bony plates each, ending in a retrose spine. Dorsal fin continuous, short, the spines graduated, 6 in number; anal with 3 graduated spines; caudal forked, its rudimentary rays spinous; pectorals low, rather long; ventrals I, 6, rather short. Air-bladder simple. Pyloric cœca numerous. Vertebræ 11 + 15. Deep-sea fishes. ( $\delta \pi \lambda \sigma \varsigma$ , armed;  $\sigma \tau \varepsilon \theta \sigma \varsigma$ , breast.)

### 719. H. mediterraneus C. & V.

Silvery, rosy in life; fins scarlet, peritoneum and inside of mouth Eye very large, much longer than snout, forming about one-third the length of head. Abdominal plates 9-13 in number. Body above with very small roughish scales; sides nearly or quite naked (in the young example seen), scaly in the adult. Pectorals reaching first soft ray of anal; ventrals to vent; fins rather low. Head 23; depth 13. D. VI, 16; A. III, 8; Lat. l. 28. Length of specimen 3 inches, lately dredged by the U.S. Fish Commission off Chesapeake Bay. Coasts of Southern Europe.

(C. & V. iv, 439; Günther, i, 9: Trachichthys speciosus Lowe, Fish. Madeira, 651.)

### 229.-INDROCENTERUS Block.

Squirrel-fishes.

(Rhynchichthys Cuv. & Val.; young.)

(Arledi: Bloch, Ausl. Fische, iv. 61, about 1787: type Holocentrus sogo Bloch.)

Body oblong, moderately compressed, the ventral outline nearly straight, the back a little elevated, the tail very slender. Head compressed, narrowed forward. Operculum with a strong spine above, below which the edge is sharply serrated; a strong spine at the angle of preopercle. Orbital ring, preorbital, preopercle, interopercle, suboperele, occiput, and shoulder girdle with their edges sharply serrate. Mouth small, terminal, the lower jaw projecting in the adult: in the young (which constitute the supposed genus Rhynchichthys), the snout is much produced. Maxillary broad, striate, with a supplemental bone. Eve excessively large. Scales large, closely imbricated, the posterior margin strongly spinous. Lateral line continuous. Dorsal deeply emarginate, the spines usually 11, depressible in a groove; soft dorsal short and high; anal with 4 spines, the first and second quite small, the third very long and strong, the fourth smaller; caudal widely forked; both lobes with the rudimentary rays spine-like; ventrals large, I, 7, the spine very strong. Species numerous, remarkable for the development of sharp spines almost everywhere on the surface of the body. (ολος, wholiv; zέντρον, spine.)

## 720. H. Dentacanthus (Bloch) Vaill. & Boc, -Spirrel-fish.

Chiefly bright red, with shining longitudinal streaks; fins not black. Mouth small, the maxillary scarcely reaching middle of orbit. Soft dorsal as high as the body; ventrals much longer than pectorals, reaching vent. Head  $3\frac{1}{2}$  in length; depth  $3\frac{1}{3}$ . Eye about  $2\frac{1}{3}$  in head. D. XI, 15; A. IV, 10; V. I, 7; Lat. I. 50. Vertebrae 11 + 16. Caca 25. West Indies; accidental on our coast; once taken at Newport, R. I. "Its bright color and nervous darting motions rendering it one of the most conspicuous denizens of the rock-pools. The local name refers to the grunting noise uttered by them, which resembles the bark of a squirrel." (Goode.)

(Bodianus pentacanthus \* Bloch, Ausl. Fische, iv, 40, taf. 225: Holocentrus sogo Bloch, Ausl. Fische, iv, 61, taf. 232: Perca rufa Walbaum, Artedi, Pisc. 1792, 351; Holocentrum longipinne Günther, i, 28; Vaillant & Bocourt, Miss. Sci. au Mex. 144.)

<sup>\* &</sup>quot;Opercula squamosa. Anteriora 5 spinis pone horrida." (Bloch.)

# FAMILY LXXXIII (a).—APHREDODERIDÆ.

(The Pirate Perches.)

Body oblong, elevated at the base of the dorsal, compressed behind. the head thick and depressed, the profile concave. Caudal peduncle Mouth moderate, somewhat oblique, the lower jaw projecting; maxillary reaching to anterior border of the eye. Teeth in villiform bands on jaws, vomer, palatines, and pterygoids. Premaxillaries not protractile; maxillaries small, without evident supplemental bone. Preopercle and preorbital with their free edges sharply serrate; opercle with a spine. Bones of skull somewhat cavernous. Sides of the head Lower pharyngeals narrow, separate, with villiform teeth. Gill-membranes slightly joined to the isthmus anteriorly. Gill-rakers tubercle-like, dentate. Pseudobranchiæ obsolete. Gills 4, a small slit behind the fourth. Scales moderate, strongly Branchiostegals 6. ctenoid, adherent. Lateral line imperfect or wanting. Vent always anterior, its position varying with age,\* from just behind the ventral fins in the young, to below the preopercle in the adult. Dorsal fin single, median, high, with but 3 or 4 spines, which are rapidly graduated, the first being very short. Anal small, with 2 slender spines; ventral fins thoracic, without distinct spine, the number of rays usually 7; caudal fin rounded behind. Air-bladder simple, large, adherent to the walls of the abdomen. Vertebræ 14 + 15. Pyloric cæca about 12. A single genus, with probably but one species. Confined to the United States.

(Aphredoderidæ Günther, i, 271.)

### 240.—APHREDODERUS Le Sueur.

## Pirate Perches.

(Le Sueur; Cuv. & Val. Hist. Nat. Poiss. ix, 445, 1833: type Aphredoderus gibbosus Le Sueur = Scolopsis sayanus Gilliams.)

Characters of the genus included above. ( $\acute{a}\varphi o\delta u z$ , excrement;  $\delta \dot{\xi}\rho \eta$ , the throat, from the position of the vent; hence more correctly *Aphododerus*.)

# 721. A. sayanus (Gilliams) DeKay.—Pirate Perch.

Color dark olive, profusely speckled with dark points which often make blackish streaks along rows of scales; two blackish bars at base of caudal, between which is a light bar. Head 3; depth 3. D. III, 11

<sup>\*</sup> This singular fact was first noticed by Professor S. A. Forbes.

(IV, 10); A. II, 6; V. 7; B. 6; Lat. l. 47-58. L. 5 inches. Shuggish streams and bayous from New York coastwise to Louisiana, and throughout the Mississippi Basin in lowlands and streams with alluvial bottoms; locally abundant, variable. The singular variations in the position of the vent have given rise to several nominal species and a nominal genus.

(Scolopsis sayanus Gilliams, Journ. Acad. Nat. Sci. Phila. iv, 81: Aphredoderus gibbosus C. & V. ix, 448: Sternotremia isolepis Nelson, Bull. Ills. Nat. Mus. i, 39, 1876: Aphrodedirus cookianus Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 60: Asternotremia mesotrema Jordan, Bull. U. S. Nat. Mus. x, 52: Aphododerus isolepis Jordan, Man. Vert. ed. 2, 249: Günther, i, 271. For description of variations in the position of the vent, see Jordan, Bull. Ill. Lab. Nat. Hist. ii, 48, 1878.)

# FAMILY LXXXIII (b).—ELASSOMATIDÆ.

(The Elassomes.)

Body oblong, compressed, covered with rather large, cycloid scales. Month small, terminal, the lower jaw projecting; both jaws with rather strong conic teeth in few series; no teeth on vomer or palatines; upper jaw very protractile. Bones of head with entire edges. Cheeks and opercles scaly. Gill-membranes broadly united, free from the isthmus; gill-rakers tubercle-like. Lower pharyngeals narrow, separate, with sharp teeth. Branchiostegals apparently 5. Lateral line obsolete. Vent normal. Dorsal fin single, small, with about 4 spines; anal with 3 spines; ventrals thoracic I, 5; caudal rounded. Pseudobranchiae none. Vertebræ 24. One species known, a very singular little fish, one of the smallest known, inhabiting the fresh waters of the United States; intermediate between the Aphredoderidæ and Centrarchidæ.

### 241.—ELASSOMA Jordan.

(Jordan, Bull. U. S. Nat. Mns. x, 50, 1877: type Elassoma zonata Jordan )
Characters of the genus included above. (ἐλασσόωμα, a diminution.)

# 729. E. zonatum Jordan.

Color olive green, everywhere finely punctulate; sides with about eleven parallel vertical bands of dark olive, about equal in width, narrower than the eye; the bands about as wide as the pale interspaces; a conspicuous roundish black spot, nearly as large as the eye, on the sides just above the axis of the body, under the beginning of the dorsal; soft fins faintly barred; a blackish bar at base of candal. Body oblong, compressed, the nape rather broad and depressed. Head narrowed forward. Eye large, 3 in head. Mouth small, oblique, the

maxillary searcely reaching pupil. Teeth in jaws stout, conical, slightly curved, in two or three rows. Head 3; depth  $3\frac{1}{2}$ . D. IV, 10; A. III, 5; B. 5; scales 42 + 19. L.  $1\frac{1}{2}$  inches. Smallest of our spinous-rayed fishes, inhabiting sluggish streams and bayous, from South Illinois to Texas and Alabama.

(Jordan, Bull. x, U. S. Nat. Mus. 50, 1877; Jordan, Man. Vert. ed. 2, 248; Jordan, Bull. Ills. Lab. Nat. Hist. ii, 47; Hay. Proc. U. S. Nat. Mus. iii, 1880, 500.)

# Family LXXXIV.—CENTRARCHIDÆ.\*

(The Sun-fishes.)

Percoid fishes with the body more or less shortened and compressed; the regions above and below the axis of the body nearly equally developed, and corresponding to each other, and the pseudobranchia im-Head compressed. Mouth terminal, large or small. in villiform bands, the outer slightly enlarged, without canines; teeth present on premaxillaries, lower jaw, and vomer, and usually on palatines also, sometimes on tongue, pterygoids, and hyoid. ries protractile; maxillary with a supplemental bone, which, in one genus, is sometimes minute or obsolete. Preopercle entire or somewhat serrate: opercle ending in two flat points or prolonged in a black flap at the angle. Preorbital short and deep; first suborbital narrow, the maxillary not slipping under its edge. Gills 4, a slit behind the fourth. Pseudobranchiæ small, almost glandular, nearly or quite covered by skin. Gill-membranes separate, free from the isthmus. Branchiostegals 6 or rarely 7. Gill-rakers variously formed, armed with small teeth; lower pharyngeal bones separate, their teeth conic or sometimes paved. Cheeks and opereles scaly. Body fully scaled, the scales usually not strongly etenoid, rarely eveloid. Lateral line present, usually complete. Dorsal fins confluent, the spines 6-13 in number (usually 10), depressible in a shallow groove; anal spines 3-9. Pyloric eœca 5-10. Vertebræ about 30. Coloration tinal canal short. usually brilliant, chiefly greenish. Sexes similar; changes with age often great. Fresh-water fishes of North America; genera 10; species about 25, forming one of the most characteristic features of our fish fauna. Many of the species build nests, which they defend with much courage. All are carnivorous, voracious, and gamy. All are valued as food in direct proportion to the size which they attain.

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<sup>\*</sup>We are indebted to Mr. Chas. L. McKay for the results of his studies of this family, in the advance of the publication of a monograph of the group.

This is a very natural and peculiar group, but its claim to recognition as a distinct family is questionable, as the only character of importance which separates it from *Serranida* is the rudimentary character of the pseudobranchiae. There is a strong analogical resemblance between the *Centrarchida* and the *Cichlida*.

(Percida, group Grystina, pt. Günther, i, 256-261.)

- a. Dorsal fin scarcely larger than anal; gill-rakers very long and slender.
  - b. Spinous dorsal longer than soft part, the spines about 12; anal spines usually 8.

    CENTRARCHUS, 242.
  - bb. Spinous dorsal shorter than soft part, the spines 5-8, anal spines 6.

Ромохуѕ, 243.

- aa. Dersal fin much larger than anal; gill-rakers shorter.
  - c. Body comparatively short and deep; dorsal fin not deeply divided.
    - d. Tongue and pterygoids with teeth; month large.
      - c. Scales etenoid; caudal emarginate.
        - f. Operculum emarginate behind; anal spines 5-7.
          - g. Branchiostegals 7. Archoplites, 244.

            qq. Branchiostegals 6. Ambloplites, 245.
        - ff. Operculum ending in a black convex process or flap; anal spines 3.
          - Cilenobryttus, 246.

    - d. Tongue and pterygoids toothless; month small.
      - h. Caudal fin convex; operculum emarginate behind.i. Dorsal fin continuous; dorsal spines normally 9; anal spines 3.
        - Enneacanthus, 248.
        - ii. Dorsal fin angulated, some of the middle spines higher than the posterior ones; dor-al spines 10; anal 3..... Mesogonistius, 249.
      - hh. Candal fin emarginate; operculum prolonged behind in a convex process or flap, which is always black.....................Lepomis, 250.

#### 242.—CENTRARCINIS Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. iii, 62, 1829: type Labrus irideus Laeépède.)

Body short and deep, compressed. Mouth moderate, the lower jaw the longer; maxillary with a well-developed supplemental bone. Teeth on vomer and palatines. Opercle emarginate behind. Gill-rakers setiform, very long, finely dentate, in large number (20–30 of the large ones). Fins large; the dorsal and anal fins about equal in extent, the soft portion of the latter longest and most posterior, the two fins being obliquely opposed; dorsal fin with the spinons part longer than the soft part, of about 12 spines, which are not rapidly graduated; anal fin with about 8 spines. Scales large, not strongly etenoid. (zευτρου, spine; αρχους, anus, from the development of the anal spines.)

# 723. C. miscropterus (Lac.) Jor.

Body ovate, strongly compressed. Head small. Mouth moderate, very oblique, the maxillary reaching pupil. Preopercle and preorbital

finely serrate; 5 or 6 rows of scales on cheek. Fins high; ventral spine reaching beyond the vent. Mandible about half the length of the head. Color green, with series of dark-brown spots on sides, below lateral line, forming interrupted longitudinal lines; belly yellowish; a dusky opercular spot; fins with reddish or brownish markings; the dark colors on vertical fins forming reticulations around paler spots; conspicuous ocellated black spot usually present on last rays of dorsal fin, especially distinct in the young, disappearing with age. Head 3½; depth 2. D. XI or XII, 12; A. VII or VIII, 15; scales 5–44–14. L. 6 inches. North Carolina to South Illinois and southward; abundant in lowland streams.

(Labrus macropterus Lacépède, Hist. Nat. Poiss. iii, 447, I802; Jordan, Bull. U. S. Nat. Mus. x, 30: Labrus irideus Lacépède, Hist. Nat. Poiss. iv, 716, 1802: Centrarchus irideus Holbr. Ichth. S. C. 1860, 18: Centrarchus irideus Günther, i, 257: Centrarchus irideus Jordan, Bull. U. S. Nat. Mus. x, 30.)

### 243.-POMOXYS Rafinesque.

# Crappies.

(Pomoxis Rafinesque, Journ. Acad. Nat. Sci. Phila. i, 417, 1818: type Pomoxis annularis Raf.)

Body more or less elongate, strongly compressed, the snout projecting. Mouth large, oblique; maxillary broad, with a well-developed supplemental bone. Teeth on vomer and palatines; few or none on tongue. Lower pharyngeals narrow, with sharp teeth. Gill-rakers long and slender, numerous. Opercle emarginate; preopercle slightly dentate. Scales large, moderately etenoid. Fins large, the anal larger than the dorsal, of 6 spines and about 17 rays; dorsal with 6–8 graduated spines, the spinous dorsal shorter than the soft part; caudal fin emarginate. Branchiostegals 7. ( $\pi\tilde{\omega}\mu\alpha$ , opercle;  $\sigma\xi \sigma_5$ , sharp; the opercle ending in two flat points instead of an "ear-flap.")

a. Dorsal spines 6. (Pomoxys.)

# 724. P. annuaris Raf.—Crappie; Bachelor; New Light; Campbellite.

Body elongate. Head long, the profile more or less strongly **S**-shaped, owing to the projecting snout, depressed occipital region, and very prominent thickened ante-dorsal area. Mouth very wide, the maxillary reaching past the pupil. Scales on cheeks in 4–5 rows. Eye large, 4 in head. Color silvery olive, mottled with dark green, the dark marks chiefly on the upper part of the body and having a tendency to form narrow vertical bars; dorsal and caudal fins marked with green; anal fin pale, nearly plain. Fins very high, but lower than in *P. sparoides*. Head 3; depth 2\frac{1}{3}. D. VI, 15; A. VI, 18; Lat. l. 36–48. L. 12 inches.

Variable. Mississippi Valley, &c.; abundant southward, chiefly in sluggish streams; valued as a food-fish.

(Rafinesque, Amer. Monthly Mag. 1818; 41; Raf. Journ. Acad. Nat. Sci. Phila. 1818, 417; Raf. Ichth. Oh. 1820, 33; Jordan & Copeland, Proc. Acad. Nat. Sci. Phila. 1876; Pomoxys storerius, brevicanda, intermedius, and protacanthus Gill, Proc. Acad. Nat. Sci. Phila. 1865, 61-66; Centrarchus nitidus Günther, i, 257.)

aa. Dorsal spines 7 or 8. (Hyperistius \* Gill.)

725. P. sparoides (Lac.) Grd.—Calico Bass; Grass Bass; Barfish; Strawberry Bass.

Body oblong, elevated, much compressed. Head long, its profile not strongly S-shaped; the projection of the snout and ante-dorsal region and the depression over the eye being less marked than in *P. annularis*. Month smaller than in *P. annularis*, the maxillary reaching about to the posterior edge of pupil, the mandible shorter than pectorals. Scales on checks in 6 rows. Fins very high; anal higher than dorsal, its height 4–5 times in length of body. Color silvery olive, mottled with clear olive-green, the dark mottlings gathered in irregular small bunches, and covering the whole body; vertical fins with dark olive reticulations surrounding pale spots; the anal marked like the dorsal; a dusky opercular spot. Head 3; depth 2. D. VH or VIII, 15; A. VI, 17 or 18; Lat. l. 41. L. 12 inches. Great Lakes and Upper Mississippi Valley to New Jersey, and southward to Florida and Louisiana; chiefly in lowland streams and lakes; a handsome fish, valued as food.

(Labrus sparoides Lacép. Hist. Nat. Poiss. iii, 1802, 517; and iv, 717: Centrarchus sparoides C. & V. iii, 8, 1829: Centrarchus hexacauthus C. & V. vii, 458, 1831: Centrarchus hexacauthus Giinther, i, 257: Pomoxys hexacauthus Holbrook, Ichth. S. C. 29: Pomoxys nigromaculatus Jordan, Man. Vert. cd. 2, 247, and Bull. U. S. Nat. Mus. x, 37, based on Cantharus nigromaculatus Le Sueur MSS., noticed by C. & V. iii, 8.)

### 944.—ARCHIOPELETES Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1861, 165: type Centrarchus interruptus Girard.)

Body oblong, compressed, the back elevated. Mouth large, oblique, the broad maxillary with a well developed supernumerary bone. Teeth on jaws, vomer, palatines, tongne, and pterygoids; lingual teeth in two patches; pharyngeal teeth pointed. Gill-rakers long and strong, compressed, numerons, about 20 in number, some of them on the upper portion of the arch. Branchiostegals 7. Operculum emarginate, the lower point much the larger, striate, the ridges terminating in small spines; preopercle, interopercle, subopercle, suborbital and preorbital with their inferior edges conspicuously serrate; dentaries and preopercle with large muciferous depressions or pits. Dorsal fin with about 13 spines; anal

<sup>\*</sup>Gill, Amer. Journ. Sci. Arts, 1834, 92: type Centrarchus hexavanthus C. & V. (ὑπηρ, high; ἰστιον, sail.)

Bull. Nat. Mus. No. 16-30

usually with 7 spines. Caudal emarginate. Scales strongly etenoid. California. (αρχος, anus; ὅπλιτης, armed.)

### 726. A. interruptus (Grd.) Gill.—Sacramento Perch.

Body oblong-ovate, compressed, the back considerably elevated anteriorly, depressed over the eye, the snont projecting at an angle. Mouth terminal, very large, the maxillary very broad, extending beyond pupil. Eye very large, 4 to 5 in head. Scales on cheek in about eight series. Dorsal spines rather low, strong; anal spines similar. Pectoral short, barely reaching anal. Color blackish above, sides silvery, with about seven vertical blackish bars, irregular in form and position and more or less interrupted; a black opercular spot; fins nearly plain. Head  $2\frac{2}{3}$ ; depth  $2\frac{1}{2}$ . D. XIII, 10; A. VII, 10; scales about 7–51–14. L. 12 inches. Sacramento and San Joaquin rivers; abundant; the only fresh-water percoid west of the Rocky Mountains.

(Centrarchus interruptus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 129: Ambloplites interruptus Girard, U. S. Pac. R. R. Surv. Fish. 10: Centrarchus interruptus Günther, i, 257: Centrarchus maculosus Ayres, Proc. Cal. Acad. Nat. Sci. i, 1854, 8.)

## 245.—AMBLOPLITES Rafinesque.

## Rock Bass.

(Rafinesque, Ichth. Oh. 1820, 33: type Lepomis ietheloides Raf.  $\equiv$  Bodianus rupestris Raf.) Body oblong, moderately elevated, compressed. Mouth large, the broad maxillary with a well-developed supplemental bone; lower jaw projecting. Teeth on vomer, palatines, tongue, and pterygoids; lingual teeth in a single patch; pharyngeal teeth sharp. Branchiostegals 6. Opercle ending in 2 flat points; preopercle serrate at its angle; other membrane bones chiefly entire. Gill-rakers rather long and strong, dentate, less than 10 in number, developed only on the lower portion of the arch. Scales large, somewhat etenoid. Dorsal fin much more developed than the anal fin, with 10 to 11 rather low spines; anal spines normally 6. Caudal fin emarginate.  $(\alpha\mu\beta\lambda\nu\varepsilon, \text{ blunt}; \delta\pi\lambda\iota\varepsilon\eta\varepsilon, \text{ armed.})$ 

# 727. A. rupestris (Raf.) Gill.—Common Rock Bass; Red-Eye; Goggle-Eye.

Body oblong, moderately compressed. Head large, the profile little depressed above the eye. Mouth large, the maxillary extending to opposite posterior part of pupil. Eye very large,  $3\frac{1}{2}$  in head. Gill rakers few, about 10 developed. Scales on checks in 6 to 8 series; preopercle serrate near its angle. Color olive green, brassy-tinged, with much dark mottling; the young irregularly barred and blotched with black, the adult with a dark spot on each scale, these forming inter-

rupted black stripes; a black opercular spot; dark mottlings on the soft dorsal, anal, and caudal. Head  $2\frac{3}{4}$ ; depth  $2-2\frac{1}{2}$ , D. XI, 10; A. VI, 10; scales about 5-39-12. Cœca 7. Vert. 14+18. L. 12 inches. Vermont to Great Lake region and Manitoba, south to Louisiana; very abundant west of the Alleghanies.

(Bodianus rupestris Raf. Am. Monthly Mag. 1817, 120; Centrarchus œucus C. & V. iii, 81; Centrarchus œucus Giinther, i, 256; Jordan, Man. Vert. ed. 2, 237; Ambloplites carifrons Cope, Journ. Acad. Nat. Sci. Phila. 1868, 217, is probably a young specimen of this species.\*)

# 246.-CHENOBRYTTUS Gill.

#### Wur-mouths.

(Calliurus Ag. not of Raf.)

(Gill. Amer. Journ. Sci. Arts, 1864, 92: type Calliurus melanops Grd. = Pomotis gulosus Cuv. & Val.)

This genus has the general form and dentition of *Ambloplites* with the convex opercle, 10 dorsal and 3 anal spines of *Lepomis*. Preopercle entire. Branchiostegals 6. Caudal fin emarginate. Scales weakly etenoid. (xuxú, to yawn; Bryttus, i. e. Lepomis.)

a. Dorsal beginning above the opercular spot.

## 728. C. antistius McKay. - Goggle Eye.

Body heavy, deep and thick, stouter and less elongate than in the next. Head deep. Mouth large, the maxillary reaching nearly to posterior margin of the eye; the supplemental bone strong. Scales on cheeks in 7 or 8 rows. Opercular flap broad. Eye small, 4½ in head; preopercle and mandible with large mucous pits. Dorsal beginning directly over the opercular spot, which is above base of pectoral; spines of dorsal very stout, the longest as long as from snout to middle of eye. Color in life dark olive-green above; sides greenish and brassy, with blotches of pale blue and bright coppery red, the red predominating; belly bright brassy yellow, profusely mottled with bright red; lower jaw chiefly yellow; iris bright red; opercular spot as large as eye, black, bordered with copper color; 3 or 4 wide dark red bands radiating backwards from eye across cheeks and opercles, separated by narrow pale blue inter-

<sup>\*</sup> A. cavifrons Cope.

Physiognomy more of Centrarchus. Month large, very oblique, the maxillary reaching beyond the middle of the pupil; chin prominent. Outline of cranium concave. Eye large, 3 in head. Scales of cheeks very few, minute. Mucous cavities large. Silvery, dusted with dark points; scales with a narrow vertical dark shade at base; soft fins dusky; a small black opercular spot. Depth 2½. D. X, 12; A. VI, 11; scales 7-38-13. Roanoke River, Virginia. (Cope.)

spaces; upper fins chiefly black, mottled with orange and blue; lower-fins dusky; a small black spot on last rays of dorsal; color in spirits very dark, the reddish shades becoming black; young with vertical chains of spots. Head  $2\frac{9}{3}$ ; depth  $2\frac{1}{8}$ . D. X, 10; A. III, 9; scales 6-40-12. L. 10 inches. Lake Michigan and Upper Mississippi Valley; abundant.

(Glossoplites melanops Jor. Man. Vert. ed. 1, 1876, 223, 317: Chænobryttus gulosus Jordan, Man. Vert. ed. 2, 1878, 237: Chænobryttus gulosus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 359, not Pomotis gulosus C. & V.; McKay, Proc. U. S. Nat. Mus. 1881.)

aa. Dorsal fin beginning behind the vertical of the base of the pectorals.

## 729. C. gulosus (C. & V.) Jor.—War-mouth: Red-eyed Bream.

Very similar to the preceding; the body more compressed and more elongate, the profile less steep. Scales of checks larger, in about 6-8 rows. Opercular spot smaller. Eye  $4\frac{1}{2}$  in head. Dorsal beginning behind base of pectoral; pectoral short, barely reaching anal. Color in life clear olive-green clouded with darker, usually without red or blue; a dusky spot on each scale more or less distinct; vertical fins mottled with dusky; a faint spot on last rays of dorsal bordered by paler; 3 oblique dusky bars radiating from eye; belly yellowish. Head  $2\frac{1}{5}$ ; depth  $2\frac{1}{2}$ . D. X, 9; A. III, 8; scales 6-43-11. L. 9 inches. Virginia to Texas; abundant only southward. Close to the preceding, but distinguishable by the posterior insertion of the dorsal.

(Pomotis gulosus Cuv. & Val. iii, 367, 1829: Centrarchus gulosus and viridis C. & V. vii, 437, 460, 1831: Centrarchus gulosus Giinther, i, 258: Calliurus floridensis Holbrook, Journ. Acad. Nat. Sci. Phila. 1855, 53: Bryttus floridensis Giinther, i, 260: Lepomis gillii Cope, Journ. Acad. Nat. Sci. Phila. 1868, 225: Chænobryttus viridis Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 330: Chænobryttus viridis Jordan, Man. Vert. ed. 2, 238: Calliurus melanops Girard, U. S. Pac. R. Surv. x, 11: Bryttus melanops Giinther, i, 260: Lepomis charybdis Cope, Journ. Acad. Nat. Sci. Phila. 1868, 24.)

#### 247.-ACANTHARCHUS Gill.

(Gill, Amer. Joarn. Sci. Arts, 1834, 92: type Centrarchus pomotis Baird.)

Body oblong, robust, not much compressed or elevated. Mouth not very large, the broad maxillary with a well developed supplemental bone; lower jaw projecting. Teeth on vomer, palatines, pterygoids, and tongue; lingual teeth in a single patch; pharyngeal teeth sharp. Gill-rakers few, rather long and strong. Opercle emarginate; preopercle entire. Scales cycloid, large. Lateral line complete. Dorsal spines usually 11; anal spines 5; caudal fin rounded behind. ( $\alpha z \alpha v \theta a$ , spine;  $\alpha \rho Z \sigma v$ , anus.)

## 730. A. pomotis (Baird) Gill.—Mud Sun-fish.

Body oblong, moderately compressed. Snout short. Month wide, the gape short; the maxillary reaching posterior part of orbit. Eye not very large,  $3\frac{1}{2}$  to 4 in head. Cheeks with about 5 rows of scales. Dorsal spines low; the longest about as long as from snout to middle of pupil. Color very dark greenish; body usually with five rather indistinct blackish longitudinal bands along the sides; cheeks with dark bands, which run nearly parallel, the lowest passing across the maxillary around the front part of the lower jaw. Fins plain dusky. A black opercular spot. Head  $2\frac{2}{3}$ ; depth 2. D. XI, 10; A. V, 10; scales 6-43-12. L. 4 inches. Southern New York to South Carolina, in sluggish streams near the coast.

(Centrarchus pomotis Baird, 9th Smithson. Rep. 1854, 325; Jordan, Man. Vert. ed. 2, 237: Centrarchus pomotis, Günther, i, 256.)

#### 248.—ENNEACANTHUS Gill

Hemioplites Cope: Copelandia Jordan.)

(Gill, Am. Journ. Sci. Arts. 1864, 92: type Pomotis obesus Grd.)

Body rather short and deep, compressed. Month small; the supplemental maxillary bone well developed. Teeth on vomer and palatines, none on the tongue. Opercle ending behind in two flat points, with a dermal border. Preopercle entire. Scales rather large, the lateral line sometimes interrupted. Dorsal fin continuous, normally with 9 spines; anal fin smaller than the dorsal, with 3 spines; caudal fin convex behind. Branchiostegals 6. Species of small size and bright coloration. Abnormal variations in the number of dorsal and anal spines have given rise to the nominal genera *Hemioplites* and *Copelandia*. (ενεεα, nine; αzανθα, spine.)

#### 731. E. criarchus (Jordan) McKay.

Body rather elongate, the profile forming a nearly uniform curve. Eye large, 3 in head. Mouth moderate, maxillary reaching slightly beyond front of pupil; its supplemental bone well developed. Scales on cheek in about 3 rows. Soft dorsal high, its longest rays equal to distance from snout to front of opercle; anal fin very large, with strong spines. Pectorals reaching beyond anal spines; ventral spines reaching anal. Lateral line incomplete. Olivaceous; vertical fins with round (blue?) spots. Head  $2\frac{3}{4}$ ; depth  $2\frac{1}{4}$ . D. X, 9; A. IV, 8; scales 4–33–10. L. 3 inches. Menomonee River, Milwaukee, Wisconsin; but one specimen preserved. It is probably an *Enneacanthus* with an abnormal in-

crease in the number of spines. Specimens of *E. simulans* with the same numbers are occasionally found.

(Copelandia criarcha Jordan, Proc. Ac. Nat. Sci. Phila. 1877, 56; McKay, Proc. U. S. Nat. Mus. 1881.)

## 732. E. obesus (Baird) Gill.

Body oblong-ovate, elliptical. Scales large, little crowded. Dorsal spines  $2\frac{1}{2}$  in head, as long as from snout to posterior margin of eye. Anal fin large; ventral spine not reaching vent, its first ray not reaching the base of the last anal spine; caudal fin moderate, about as long as from snout to middle of opercle; opercular spot rather large, more than half the size of the eye, velvet black, bordered with purple. Eye  $3\frac{1}{4}$  in head; cheeks with four rows of scales. Color olivaceous, with 5–8 well-defined dark cross-bars; spots on body and fins purplish or golden; cheek with lines and spots; a dark bar below eye. Head  $2\frac{2}{3}$ ; depth  $1\frac{4}{5}$ . D. IX, 10; A. III, 10; scales 4–32–10; the pores developed usually on about 20 scales, but sometimes on nearly all of them. L. 3 inches. Massachusetts to Florida, abundant in sluggish streams near the coast.

(Pomotis obesus Baird, 9th Smiths, Rept. 1854, 324: Bryttus obesus Girard, Proc. Acad. Nat. Sc. Phila. 1859, 53; Jordan, Man. Vert. 245: Bryttus fasciatus Holbrook, Journ. Acad. Nat. Sci. Phila. 1855, 51: Bryttus fasciatus Günther, i, 260; Cope, Proc. Acad. Nat. Sci. Phila. 1878, 65: Pomotis guttatus Morris, Proc. Acad. Nat. Sci. Phila. 1859.)

## 733. E. gioriosus (Holbr.) Jor.

Body oval, moderately compressed, the profile coneave above eye. Opercular spot scarcely larger than pupil. Caudal about as long as from snout to anterior margin of preopercle. Color olive-green, yellowish below, speckled above with golden; no vertical bands; fins rosy, with golden spots, often a dusky spot at base of caudal. Head  $2\frac{1}{4}$ ; depth  $1\frac{1}{2}$ . D. IX, 11; A. III, 10. L.  $2\frac{3}{4}$  inches. Maryland to Florida, in clear sluggish streams.

(Bryttus gloriosus Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 51: Bryttus gloriosus Günther, i, 250; Uhler & Lugger, Fishes Maryland, 112.)

#### 731. E. simulans (Cope) McKay.

Body comparatively elongate. Mouth moderate, very oblique, the maxillary reaching just past the front of orbit. Dorsal spines medium; soft rays in the males somewhat elevated, reaching to or beyond (var. pinniger) the base of the caudal; the longest soft ray as long as from snout to front of opercle, or (var. pinniger) as long as head; fins in females all lower; pectoral fin reaching nearly to middle of anal. Eye 3½ in head. Lateral line usually, but not always, complete. Color dark olive; young with traces of vertical darker bars; ear-flap small, with a

blue border, and a pearly spot in front; a dark bar about width of pupil extending obliquely downwards below eye; sides of head, whole body and vertical fins, in the males, with round bright blue spots arranged in irregular rows, these spots most distinct on the cheeks and opercles and on the lower part of the sides; females duller, with larger and fainter spots more regular in position. A dark bar below eye. Head  $2\frac{3}{4}$ ; depth  $2\frac{1}{4}$ . D. IX, 10; A. IH, 9 (occasionally D. X, or A. IV, in abnormal specimens); scales 3–30–9. New Jersey to North Carolina; abundant near the coast.

(Hemioplites simulaus Cope, Journ. Acad. Nat. Sci. Phila. 1868, 218; based on specimen with 4 anal spines: Enneacanthus margarotis Gill & Jordan, Bull. U. S. Nat. Mus. x, 28, 1878: Enneacanthus guttatus Cope, Journ. Acad. Nat. Sci. Phila. 1869, 219: Enneacanthus pinniger Jordan, Bull. U. S. Nat. Mus. x, 27, 1878, a southern form, distinguished by the larger size, brighter color, and larger fins, all doubtless the result of more favorable surroundings.)

#### 219.—MESOGONISTIUS Gill.

## Banded Sun-fishes.

(Gill, Amer. Journ. Sci. Arts, 1864, 92: type Pomotis chatodon Baird.)

Body short and deep, compressed. Month small. Teeth present on vomer and palatines, none on the tongue; supplemental maxillary bone small. Gill-rakers rather strong, dentate. Opercle ending in two flat points, with a dermal border; preopercle entire. Scales large. Dorsal with ten spines; outline of the fin angulated, the middle spines being much longer than some of the posterior ones; anal fin much smaller than the dorsal, with 3 spines; caudal fin posteriorly rounded. Size small. ( $\mu z \sigma \sigma z$ , middle;  $\eta \omega z \sigma z$ , angle;  $\delta \sigma \tau t \sigma z$ , sail.)

## 735. M. chætodon (Baird) Gill.—Black-banded Sun-fish.

Body suborbicular, compressed. Head moderate, the profile nearly concurrent with the dorsal curve. Mouth very small, the maxillary reaching nearly to the eye. Eye large, 3 in head. Cheeks with 3-4 rows of scales. Fins rather large; dorsal fin high in front, the middle portion depressed. Lateral line continuous. Coloration clouded straw-color, the sides with 6-8 conspicuous but rather irregular black vertical bars, the first through the eye, the second in front of pectorals, interrupted on the operculum, the third at the front of the dorsal covering the membrane of the first three spines, and forming a medial black stripe on each ventral fin, the fourth at front of soft dorsal, the fifth opposite its last ray, the last at the base of the caudal; black opercular spot, with a crescent-shaped paler centre. Fins mottled. Head 3;

depth 12. D. X, 10; A. III, 12; scales 4-28-10. L. 3 inches. New Jersey to Maryland, in sluggish streams. A handsome little fish.

(Pomotis chwtodon Baird, Ninth Smithsonian Report, 1854, 324: Pomotis chwtodon Giinther, i, 263; Jordan, Man. Vert. ed. 2, 245.)

## 250.-LEPOMIS Rafinisque.

## Sun-fishes.

(Ichthelis, Pomotis and Apomotis Rafinisque: Bryttus Cuv. & Val.: Xenotis, Xystroplites and Helioperea Jordan: Eupomotis Gill & Jordan.

(Rafinesque, Journal de Physique, 1819, 402: type Labrus auritus L.)

Body oblong or ovate, more or less compressed, the back in the adult somewhat elevated. Mouth moderate or small, the jaws about equal; maxillary narrow, the supplemental bone small or reduced to a mere rudiment or altogether wanting. Teeth on vomer, and usually on palatines; none on tongue or pterygoids; lower pharyngeals narrow, the teeth conic or paved. Gill-rakers mostly short; preoperculum entire; operculum ending behind in a convex flap, black in color, which in some species becomes greatly developed with age. Branchiostegals 6. Scales moderate. Dorsal fin continuous, with ten spines; anal with three spines; caudal fin emarginate. Coloration brilliant, but evanescent. A large genus, one of the most difficult in our fish fauna in which to distinguish species. The form of body, development of ear-flap, and height of spines vary greatly with age. The number of fin-rays and scales are essentially the same in all. ( $\lambda \varepsilon \pi \iota z$ , scale;  $\pi \tilde{\omega} \mu a$ , operculum, a character supposed to distinguish the genus from  $\mathcal{S}parus$ .)

The species may be subdivided as follows:

- \* Lower pharyngeals narrow, the teeth mostly conic.
  - a. Pharyngeal teeth all, or nearly all, slender, acute.
    - b. Supplemental maxillary bone well developed; palatine teeth present; gill-rakers stiff and rather long. (Apomotis Raf.).cyanellus, symmetricus, phenax. bb. Supplemental maxillary reduced to a slight rudiment.
      - c. Gill-rakers stiff, not very short; palatine teeth usually present. (Lepomis.)
         d. Gill-rakers comparatively long and slender; ear-flap short.
        - ischyvus, macrochivus, mystacalis, elongatus, murinus, punctatus, miniatus. dd. Gill-rakers short, thickish; ear-flap very long and narrow in the adult.
          - auritus
      - ce. Gill-rakers weak and flexible, very short; no palatine teeth. (Xenotis Jordan.)

        megalotis, marginatus, bombifrons.
    - bbb. Supplemental maxillary obsolete; gill-rakers slender. (Helioperea.)
  - aa. Pharyngeal teeth mostly bluntly conic. (Xystroplites Jordan.)

heros, euryorus, albulus.

\*\* Lower pharyngeals broad, with the teeth paved, nearly spherical, trnneate above.

Eupomotis Gill & Jordan).....notatus, holbrooki, gibbosus, lirus.

- a. Pharyngeal teeth all or nearly all slender, acute; lower pharyngeals narrow, the teeth mostly conic.
  - b. Supplemental maxillary evident; palatine teeth present; gill-rakers stiff and rather long. (Apomotis \* Ratinesque.)

## 736. L. cyanellus Raf.—Red-eye; Blue-spotted Sun-fish.

Body oblong, rather elongate, becoming short and deep with age: moderately compressed. Head large, with projecting snout. rather large, the maxillary broad and flat, with a small supplemental bone, reaching nearly to the middle of the eye; lower jaw projecting. Dorsal spines quite low, the highest scarcely longer than snout (in the adult, longer in young). Scales small. Opercular spot small, less than eve, broadly margined, the black confined to the bony part. Pectoral short, not reaching anal. Color variable, the prevailing shade green, with a strong brassy lustre on sides, which becomes nearly vellow below: each scale usually with a sky-blue spot and more or less of gilt edging, giving an appearance of pale lateral streaks; besides these marks, dusky or obscure vertical bars are often present, and the sides are sprinkled with dark dots; vertical fins marked with blue or green, the anal usually edged in front with pale orange; usually a conspicuous black spot on posterior base of dorsal and anal, these often obsolete: iris red: cheeks with narrow blue stripes. Scales on cheeks in 8 rows. Head 3; depth 23. D. X, 11; A. III, 9; Lat. l. about 48 L. 7 inches. Very variable. Great Lake region to Mexico; very abundant southwestward; ascending small brooks.

(Raf. Journ. de Physique, 1819, 420: Icthelis melanops Raf. Ichth. Oh. 1820, 28: Calliurus longulus, diaphanus, formosus, and microps Girard, U. S. Pac. R. R. Surv. Fish. and U. S. Mex. Bound. Surv. Ichth. 1859: Bryttus signifer Grd. U. S. Pac. R. R. Surv. Fish. 20: Bryttus longulus Günther, i, 260: Lepomis microps, mincopus, and melanops Cope, Journ. Acad. Nat. Sci. Phila. 1868–223, 224: Apomotis eyanellus Jordan, Man. Vert. E. U. S. ed. 2, 239.)

#### 737. L. symmetricus Forbes, sp. nov.

Color dark, most scales with a vertical dark bar at base; cheeks mottled, not striped; sides with about 10 vertical bars, widest forward; pectoral fins pale; ventrals dusky in the male; dorsal fin in the female with a dark occllated spot on its last ray. Body short, deep, with regular outlines. Mouth moderate, the lower jaw longest, the maxillary reaching the front of the pupil; supplemental maxillary present. Palatine teeth present; pharyngeal teeth rather blunt. Gill-rakers stiff and long. Cheeks with 7 rows of scales. Opercular angle not prolonged,

<sup>\*</sup>Rafinesque, Jonrn. de Physique, etc., 1819, 420: type *Lepomis cyanellus* Raf.;  $\alpha$ , primitive;  $\pi \tilde{\omega} \mu \alpha$ , operculum; ov5, ear=Telipomis Raf. 1820.

its black spot higher than long, shorter than eye with a narrow pale border. Spinous dorsal rather low, two-thirds height of soft, the longest spine as long as from snout to middle of eye; caudal peduncle short and deep; caudal slightly emarginate; pectorals and ventrals reaching vent. Head  $2\frac{9}{3}$ ; depth  $1\frac{3}{4}$ . Eye a little longer than snout,  $3\frac{9}{3}$  in head. D. X, 10; A. III, 9; scales 6-34-14. L.  $2\frac{1}{2}$  inches (adult). Types 15 specimens, in Illinois Laboratory of Natural History from Illinois River. (Forbes MSS.)

## 738. L. phenax (Cope & Jordan) McKay.

Appearance of *Lepomis pallidus*. Body rather short and deep; snout short, projecting, forming an angle over the eye. Mouth moderate, the lower jaw slightly the longer, the maxillary reaching middle of eye, the supplemental bone strong. Eye moderate,  $4\frac{1}{2}$  in head. Opercular spot larger than eye. Scales on cheek in 7 rows. Gill-rakers very long. Dorsal spines short and strong, as long as from snout to middle of eye; pectorals long; soft dorsal high, anal higher. Color in spirits nearly plain olive-green; no black spot on dorsal or anal. Head  $2\frac{1}{2}$ ; depth  $2\frac{1}{5}$ . D. X, 10; A. III, 9; scales 6-43-14. L. 6 inches. Beaseley's Point, New Jersey.

(Apomotis phenax Cope & Jordan, Bull. U. S. Nat. Mus. x, 26, 1877; McKay, Proc. U. S. Nat. Mus. 1881.)

- bb. Supplemental maxillary reduced to a slight rudiment.
  - c. Gill-rakers stiff, not very short; palatine teeth usually present. (Lepomis.)
    d. Gill-rakers comparatively long and slender; ear-flap short.

#### 739. L. ischvrus Jor. & Nelson.

Aspect of L. pallidus. Body elongated, robust, much elevated. Mouth wide, the maxillaries reaching middle of orbit. Palatine teeth present. Occiput prominent; top of head flat and short, forming an angle with the descending profile. Scales on cheeks in 6 rows. Fins high, the dorsal spines rather low and very strong, the longest as long as from tip of snout to middle of orbit. Opercular flap large, with a broad pale edge, entirely surrounding the black. Eye large, smaller than opercular spot,  $4\frac{1}{2}$  in head. Color dusky, mottled with orange and blue; cheeks with wide obscure blue bands; a dusky spot on dorsal and anal behind; belly and lower fins coppery yellow; lower jaw and lower parts of head leaden blue. Head  $2\frac{1}{3}$ ; depth,  $2\frac{1}{6}$ . D. X, 12; A. III, 10; scales 5-46-14. L. 7 inches. Illinois River.

(Ichthelis aquilensis Nelson, Bull. Ills. Mus. Nat. Hist. i, 37 (not Pomotis aquilensis B. & G.); Jordan & Nelson, Bull. U. S. Nat. Mus. x, 25, 1877.)

## 740. L. macrochirus Raf.

Bright steel-blue, with many bronze orange spots, which cover nearly the whole surface, so arranged that the ground color forms a series of vertical chain-like bars, very conspicuous in life; vertical fins mottled with bronze and usually more or less edged with pale orange; sometimes a faint black dorsal spot; no distinct blue stripes on cheek, but the sides of the head shaded with purplish. Opercular flap small, black. margined with pale. Body rather elongate, the head somewhat acute. Pectoral fins reaching beyond ventrals to anal. Gill-rakers rather long and slender, strongly toothed, 11 developed. Supplemental bone minute. About 7 rows of scales on cheeks. Head 3; depth 24. D. X, 12; A. III, 10; scales about 6-42-15. L. 5 inches. Ohio Valley; a small. handsome species.

(Raf. Journ. de Physique 1819, 420; Jordan, Man. Vert. ed. 2, 239: Lepomis nephelus Cope, Journ. Acad. Nat. Sci. Phila, 1868, 222.)

## 741. L. mystacalis Cope.

Body deep, compressed. Eye large, 3\frac{1}{3} in head. Dorsal spines robust, little shorter than the soft rays; paired fins long; maxillary extending somewhat beyond front of orbit; four rows of scales on cheeks; opercular spot short without border. Gill-rakers slender. Dusky, sides silvery, with irregular, short, dark vertical bars; a pale band from mouth across preopercle, a dark line below this, then a silvery band; lower parts and most of vertical fins yellow. Head 33; depth 2. D. X, 12; A. III, 12; scales 7-51-15. East Florida. (Cone.) (Cope, Proc. Am. Philos. Soc. 1877, 66.)

## 742. L. clongatus (Holbr.) Gill & Jor.

Body rather elongate, compressed. Front steep. Caudal peduncle long. Maxillary extending to front of eye. Eye large, 31 in head. Scales on check in 6 rows. Opercular flap moderate. Fins high, the longest dorsal fin as long as snout and eye. Dusky above, yellowish below, with faint dark vertical bars on the sides, and a dark blotch on the tail behind the dorsal fin; cheeks with pale bluish lines; fins plain. Head  $2\frac{3}{3}$ ; depth  $2\frac{1}{2}$ . D. X, 11; A. III, 9. L. 4 inches. South Carolina to Florida. (Holbrook.)

(Pomotis elongatus Holbr. Journ. Acad. Nat. Sci. Phila, 1855, 47: Pomotis elongatus Günther, i, 262: ? Lepomis ophthalmicus Cope, Journ. Acad. Nat. Sci. Phila. 1868, 221.)

#### 743. L. murimus (Grd.) McKay.

Body elongate, somewhat compressed, the form precisely as in L. eyanellus. Mouth rather large; maxillary about reaching front of eye; teeth on vomer and front of palatines. Gill-rakers moderate, 9 or 10 developed. Supplemental maxillary scarcely appreciable. Eye equal to interorbital width. Cheeks with 7 rows of scales. Spinous dorsal rather high, the longest spine about as long as from tip of snout to pupil; pectorals short, scarcely reaching vent. Scales small, reduced on breast. Dark greenish; a black spot on dorsal as in *L. cyanellus*. Head  $2\frac{3}{5}$ ; depth 3. D. X, 10; A. III, 9; scales 7-42-15. Texas.

(Calliurus murinus Grd. U. S. Pac. R. R. Surv. Fish. 1858, 18, pl. 7, fig. 1; the other specimens examined by Girard belong to L. cyanellus: Bryttus murinus Günther, i, 260; McKay, Proc. U. S. Nat. Mus. 1881, 88.)

## 744. L. pumctatus (Cuv. &. Val.) Jor.

Body deep, compressed, the profile steep; an angle above the eye. Mouth moderate; maxillary reaching past anterior margin of eye; supplemental maxillary present, small. Palatine teeth present. Gill-rakers rather long, stiff, and strong. Opercular flap small, short, and deep, shorter than eye. Eye large, 4 in head. Scales on the cheeks in 7 rows. Dorsal spines high, the middle ones highest, nearly as long as snout and orbit. Olivaceous, with numerous small deep brown spots, smaller than pin-heads, resembling fly-specks; these are most distinct on the lower part of the sides, where they form lines along the rows of scales, and on the opercles; sometimes they cover the whole body. Fins plain dusky. Head 3; depth 1½. D. X, 11; A. III, 10; scales 6-40-13. L. 5 inches. Streams of Florida; a handsome species, known at sight by the peculiar coloration.

(Bryttus punctatus and reticulatus Cuv. & Val. vii, 402; Jordan, Proc. U. S. Nat. Mus. ii, 224, 1879: Lepomis apiatus Cope, Proc. Am. Phil. Soc. Phila. 1877, 65: Lepiopunus apiatus Jordan, Bull. U. S. Nat. Mus. x, 25, 1877.)

## 745. L. mimiatus Jordan.

Body oblong and somewhat regularly elliptical. Mouth rather large. Opercular flap short and broad, entirely black. Scales of cheek in 4 series. Eye large,  $3\frac{1}{2}$  in head. Gill-rakers shortish, but stiff and rough. Palatine teeth present. Dorsal spines rather long, as long as from snout to posterior edge of pupil. Pectorals long. Color dark, a scarlet spot on each scale, forming red longitudinal stripes; a dusky mark on each side of each red spot; belly largely orange red; fins dark; no dorsal spot; iris red. Head  $2\frac{3}{4}$ ; depth  $2\frac{1}{4}$ . D. X, 10; A. III, 9; scales 4–40–11. L. 4 inches. Alabama to Texas; not rare; a small, brightly colored species.

(Jordan, Bull. U. S. Nat. Mus. x, 26, 1877.)

dd. Gill-rakers short, thickish; ear flap in the adult very long and narrow.

## 746. L. auritus (L.) Raf.—Long-eared Sun-fish.

Body elongate, not much elevated. Shout moderately prominent. Mouth rather large, oblique, the maxillary reaching past front of eye. Cheeks with rather small scales, in about 7 rows. Scales of breast very small. Palatine teeth few, rather large. Gill-rakers quite short, not much longer than in Lepomis megalotis, but stiff and rough, set wide apart, diminishing in size from the angle forwards. Opercular flap very long (longer in the adult than on any other of the Sun-fishes except Lenomis megalotis), narrow, usually not wider than the eye. In the young the flap is variously shorter, but always narrow; lower margin of flap usually pale. Dorsal spines rather low. Color olive: belly largely orange red; scales on the sides with reddish spots on a bluish ground; vertical fins chiefly orange or yellowish; head with bluish stripes, especially in front of eye; fins becoming dusky in spirits; no dusky blotch on last rays of dorsal and anal. Head (without flap) 3 in length; depth 2½. D. X, 11; A. III, 9; Lat. l. 47. L. 8 inches. Maine to Louisiana; abundant in all streams east of the Alleghanies; the typical form, above described, chiefly northward.

(Labrus auritus Linn. Syst. Nat. ed. x, 283, 1758: Labrus auritus Linn. Syst. Nat. ed. xii, 475, 1766: Bryttus unicolor Cuv. & Val. vii, 464: Pomotis rubricauda Storer, Bost. Journ. Nat. Hist. iv, 177: Pomotis appendix Storer, Hist. Fish. Mass. 1867, 14.)

Var. solis (Cuv. & Val.) McKay.

Similar to the preceding, except that the scales on the cheek are larger, in 5 or 6 rows; the scales on the breast are not very small, and there is usually a dusky blotch on the last rays of the dorsal. Virginia to Louisiana, in streams coastwise; abundant, replacing the true *auritus* in the streams of the Southern States.

(Pomotis solis Cuv. & Val. vii, 468: Ichthelis rubricauda Holbrook, Ichth. S. C. 1860, 15; McKay, Proc. U. S. Nat. Mus. iv, 89.)

cc. Gill-rakers weak and flexible, very short; palatine teeth none. (Xenotis\* Jordan.)

#### 747. L. megalotis (Raf.) Cope.—Long-cared Sun-fish.

Body short and deep, compressed, the back very strongly arched; the profile very steep, usually forming an angle above eye, but sometimes full and convex. Mouth small, oblique, the premaxillary rather below the eye, the maxillary extending to opposite middle of eye. Scales on cheek rather large, in about 5 rows. Dorsal spines very low, not much longer than the snout. Opercular flap in the adult very long and broad, with a broad or narrow pale blue or red margin, the margin sometimes

<sup>\*</sup> Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 76: type Pomotis fullax B. & G. (ξενος, wonderful; ους, ear.)

very broad, sometimes almost wanting; the flap half or more longer than the eye in the adult, much shorter in the young, its development subject to great variation. Brilliant blue and orange: the back chiefly blue; the belly entirely orange, the orange on the sides in spots, the blue in wavy vertical streaks; lips blue; cheeks orange, with brightblue stripes: blue stripes before eye; iris red; soft parts of vertical fins with the rays blue and the membranes orange; ventrals dusky. without flap, 3 in length; depth 12-21. D. X, 10; A. III, 8; scales 5-38-14. L. 6 inches. Michigan to Minnesota, South Carolina, and Mexico; very abundant in most streams. One of our most brightly-colored fishes. Extremely variable: the young are often elliptical in form, and the size at which the characteristic ear-flap is developed varies greatly with different individuals. We have thus far failed to distinguish any tangible varieties. Some Southern specimens have the ear-flap longer (fallax); some Northern ones have the scales rather larger (inscriptus), or the margin of the ear-flap broader than usual (peltastes), or wanting altogether (lythrochloris). Some Southern specimens (breviceps) have a dusky spot on the last rays of dorsal. These characters gradually disappear on examination of a large series.

(Ichthelis megalotis Raf. Ichth. Oh. 1820, 29: Xenotis megalotis Jordan, Man. Vert. ed. 2, 242: Ichthelis aurita Raf. Ich. Oh. 1820, 29, not Labrus auritus L.: Lepomis auritus Cope, John. Acad. Nat. Sci. Phila. 1868, 220: Xenotis lythrochloris Jordan, Bull, U. S. Nat. Mus. x, 40: Pomotis nitida Kirtland, Bost. John. Nat. Hist. iii, 472: Pomotis fallax Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 24: Pomotis fallax Girard, U. S. Pac. R. R. Surv. Fish. 27: Pomotis rubricauda Günther, i, 252: Pomotis breviceps B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390: Pomotis popci Girard, U. S. Pac. R. R. Surv. Fish. x, 26: Pomotis sanguinolentus Agass. Amer. Journ. Sci. Arts, 1854, 302: Xenotis solis Jordan, Bull. U. S. Nat. Mus. x, 22, not Pomotis solis C. & V.: Pomotis convexifrons Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 24: Xenotis aureolus Jordan, Bull. U. S. Nat. Mus. x, 41: Pomotis inscriptus Agassiz, Amer. Journ. Sci. Arts, 1854, 302: Xenotis inscriptus Jordan, Bull. U. S. Nat. Mus. x, 42: Lepomis peltastes Cope, Proc. Amer. Phil. Soc. Phila. 1870, 454; McKay, Proc. U. S. Nat. Mus. iv, 89.)

## 748. L. marginatus (Holbr.) McKay.

Body short and deep. Snout shorter than the diameter of the eye, the maxillary extending to the orbit. Paired fins rather long. Color olive, with darker vertical bars; head and body with numerous bluishgreen spots; opercular appendix bordered with green. Head 3; depth 2. D. (IX) X, 12; A. III, 10. Fior da. (Holbrook.)

(Pomotis marginatus Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 49: Pomotis marginatus Günther, i, 264.)

## 749. L. bombifrons (Agass.) Jor.

Body rather short and deep, with the profile very steep and the back very much arched, the greatest depth of the body being over the opercles; opercular flap very small, unmargined. Eye large; a slight angle in front of the eye. Gill-rakers unknown. Mouth moderate, placed very low; the premaxillaries entirely below the eye; maxillary extending back to the middle of the pupil. Dorsal spines moderate, the last ones somewhat shortened. Anal fin large; pectorals and ventrals reaching anal. Scales of check in 5 rows. Light brown; fins pale, unspotted. Scales of belly and sides dotted with golden orange. Head  $2\frac{3}{4}$ ; depth  $2\frac{1}{8}$ . D. X, —; A. III, —; scales 5-?-11. L. 4 inches. (Agassiz.) Tennessee River. Known to us from the original description and from a tracing of a drawing received from Professor Bliss.

(Pomotis bombifrons Agassiz, Amer. Jonru. Sci. Arts, 1854, 303.)

aaa. Supplementary maxillary obsolete; gill-rakers slender, rather stiff. (Helioperca\* Jordan.)

d. Palatine teeth present.

# 750. L. humilis (Grd.) Cope.—Red-spotted Sunfish.

Body oblong. Scales large. Spines rather high. Profile not very steep. Eye 3½ in head; mucous pores on head very large; opercular flap rather long, broad, with a very broad red margin which entirely surrounds the black. Gill-rakers rather long, blunt, 8–10, well developed; cheeks with about 5 rows of scales. Bluish, with conspicuous greenish spots and mottlings posteriorly; sides with many conspicuous round salmon-red spots; usually a faint black spot on last rays of dorsal; belly and lower fins red. Head 2¾; depth 2¼. D. X, 11; A. HI, 9; scales 5–34–11. L. 3 inches. Kentucky to Kansus and Texas; locally abundant; a small, highly-colored species.

(Bryttus humilis Girard, Proc. Acad. Nat. Sci. Phila, 1857, 201; Girard, U. S. Pac. R. R. Surv. Fish. 1858, 21; Lepomis anagallinus Cope, Journ. Acad. Nat. Sci. Phila, 1868, 221; Lepomis anagallinus Jordan, Man. Vert. ed. 3, 240; † Bryttus oculatus† Cope, Proc. Acad. Nat. Sci. Phila, 1865, 83; † Lepomis oculatus Cope, Journ. Acad. Nat. Sci. Phila, 1868, 221.

dd. Palatine teeth none; a black blotch on last rays of dorsal.

# 751. L. pallidus (Mitch.) Gill & Jor.—Blue Sunfish; Copper-nosed Bream; Dollardee.

Body comparatively short and deep, compressed; the young slender, the adult nearly orbicular. Caudal pedancle rather slender. Head not

<sup>\*</sup> Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 355: type Labrus pallidus Mitch. ( $\eta\lambda\iota\sigma\nu$ , sun;  $\pi\varepsilon\rho\nu\eta$ , perch.)

<sup>†</sup>L. oculatus Cope.

Similar to *L. humilis*, but the body deeper, the caudal peduncle and fin forming but one-third of the length. Head short; opercular flap long, with a black spot as large as eye, surrounded by a broad pale margin; body without red spots. Depth 2\frac{1}{2}. Scales 5-32-11. L. 3. (Cope.) Minnesota.

large, the projecting snout usually forming an angle above eye. Mouth quite small, oblique, the jaws about equal, the maxillary barely reaching the front of the eye. Five rows of scales on cheeks. Opercular flap very short in the young: in the adult rather long and wide, without pale edge. Gill-rakers moderately long, nearly terete, bent slightly downwards, about 10 well developed. Dorsal spines strong and high. usually longer than snout and eye. Ventral fins reaching anal; pectorals reaching past anal spines. Olive green; adults dark; young more or less silvery, with a purple lustre in life; sides with undulating, often chain-like, transverse greenish bars, which become obsolete in the adult; no blue stripes on cheeks; a diffuse black blotch at base of posterior rays of dorsal and anal, often obscure in young; no red on fins; very old specimens often with the belly coppery red. Head 3; depth 2. D. X. 11: A. III, 10: Lat. l. 44. L. 8 inches. Great Lakes to Florida and Mexico; very abundant; one of our most widely diffused and variable species.

(Labrus palladus Mitchill, Trans. Lit. & Phil. Soc. N. Y. 1815, 407; Jordan, Man. Vert. 241: Labrus appendix Mitchill, Amer. Month. Mag. 247, 1618 (not Pomotis appendix of anthors): Pomotis incisor C. & V. vii, 466: Pomotis incisor Giinther, i, 269: Ichthelis incisor Holbrook, Ichth. S. C. 12: Pomotis gibbosus C. & V. vii, 467: Pomotis speciosus, and aquilensis B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 24: Pomotis speciosus Giinther, i, 263: Pomotis buna Grd. U. S. Pac. R. R. Surv. Fish. x, 22: Lepomis longispinis, megalotis, and ardesiacus Cope, Journ. Acad. Nat. Sci. Phila. 1868, 220, 222: Lepomis purpurascens Cope, Proc. Amer. Phil. Soc. Phila. 1870, 453: Pomotis obscurus\* Agassız, Amer. Journ. Sci. Arts, 1854, 302: Lepiopomus obscurus Jordan, Ann. Lyc. Nat. Hist. 1876, 317, a deeply colored variety, from the Tennessee Basin and southward.)

aa. Pharyngeal teeth mostly bluntly conie. (Xystroplites † Jordan.)

## 752. L. heros (B. & G.) McKay.

Appearance of *Lepomis pallidus*. Body robust, deep; the front steep, the projecting snout forming a considerable angle at the eye. Caudal peduncle rather long. Mouth moderate. Eye large. Scales on cheeks in 4 or 5 rows. Opercular flap broad, about as large as eye, with an orange margin below and behind. Spines strong and rather high.

<sup>\*</sup>The life colors of "Lepomis obscurus" are as follows:

Dark green above, the shoulders and front of back with distinct greenish-black spots; sides with wide dark-green bars; chest bright coppery-red, spotted with black-ish and orange; sides of belly with blackish and carmine; face, lower jaw, and lower parts of head of a peculiar bright leaden blue; checks orange and lead-blue, not striped; opercular spot large, all black; vertical fins dark blue-green; a black spot on last rays of dorsal and anal.

<sup>+</sup>Jordan MSS. Cope, Proc. Amer. Philos. Soc. 1877, 66: type Xystroplites gilli Jordan = Bryttus albulus Grd. ( $\xi v \delta \tau \rho \sigma v$ , a scraper—gill-raker;  $\delta \pi \lambda \iota \tau \eta s$ , armed.)

Pectoral fins long. Olivaceous, plain in spirits; belly silvery; checks not striped; usually a faint spot on last rays of dorsal, and sometimes of anal also. Head  $2\frac{3}{4}$ ; depth 2. D. X, 12; A. III, 11; scales 5–39–15. Texas; one specimen known; distinguishable from *Lepomis pallidus* only by the blunt teeth.

(Pomotis heros Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 25; Pomotis heros Grd. U. S. Mex. Bound. Surv. Ichth. 6; Xystroplites heros Jordan, Man. Vert. ed. 2, 244.)

## 753. L. euryorus McKay.

Body very robust, compressed; form nearly oval; dorsal outline more convex than ventral; profile steep, convex. Month oblique, small; maxillary reaching front of eye. Outer teeth stronger than others; teeth on front of palatines. Lower pharyngeals with the rather long posterior spur turned up, stoutish; the inner angle rounded, somewhat obtuse. Teeth stout, very much blunted, not close set; the inner considerably stronger and less blunt than the rest. Gill rakers short, stout, about eight in number, the inner surface roughened. Maxillary with a small but perfectly distinct supplemental bone. Eye very small, considerably less than length of snout. Scales on cheeks in 6-7 rows. Opercular flap nearly as long as snout, surrounded by a very broad, paler, membranous margin; scales on the opercle large, in 5 rows. Dorsal spines low, the longest as long as from snout to eye; much lower than soft rays. Caudal peduncle and fin short and broad; ventrals and pectorals short, reaching vent. Scales on breast larger than those on checks. Head  $3\frac{3}{4}$ ; depth  $2\frac{5}{5}$ . D. X, 11; A. III, 10; scales 6-43-14. L. 62 inches. Lake Huron; one specimen known.

(McKay, Proc. U. S. Nat. Mus. 1881, 89.)

## 754. L. albuļus (Grd.) McKay.

Body elongate, rather deep mesially. Caudal peduncle rather elongate. Snout projecting, forming an angle above eye. Mouth wide, the lower jaw projecting; maxillary reaching just past front of pupil. Eye as long as opercular flap, 4½ in head; flap moderate, broad, with a very wide pale edge below and behind. Dorsal spines moderate, as long as snout and half of orbit. Five rows of scales on cheek. Lower pharyngeal teeth blunt, almost paved. Light olive, uniform in spirits; traces of dusky mottlings on last rays of dorsal and anal. Head 2½; depth 2. D. X, 10; A. III, 9; scales 6-42-13. L. 5 inches. Florida to

Texas; not common; like the preceding species, intermediate between *Lepomis* proper and *Eupomotis*.

(Bryttus albulus Grd. Proc. Acad. Nat. Sci. Phila. 1857; Girard, U. S. Pac. R. R. Surv. x. 19; Bryttus albulus Giinther, i, 259; Xystroplites gilli Jordan, Bull. U. S. Nat. Mus. x, 24, 1877; McKay, Proc. U. S. Nat Mus. 1881, 89.)

\*\* Lower pharyngeals broad; pharyngeal teeth paved, subspherical in form, truncate above. (Eupomotis Gill & Jordan.\*)

## 735. L. holbrooki (Cuv. & Val.) McKay.

Body robust, elevated, the snout rather produced. Eye large, 4 in head; maxillary reaching front of orbit. Dorsal fin high, the spines about as high as the soft rays; pectoral fins very long. Cheeks with 5 rows of scales. Gill-rakers rather long, obtuse, strongly toothed. Opercular flap short, broad, with a broad orange margin below and behind. No palatine teeth; pharyngeal teeth paved. Dusky olive, silvery below; throat yellow; fins dark, with yellowish rays; no black dorsal spot. Head  $3\frac{3}{3}$ ; depth  $2\frac{1}{4}$ . D. X, 12; A. III, 11. L. 10 inches. South Carolina to Florida; abundant.

(Pomotis holbrooki Cuv. & Val. vii, 466, 1831: Pomotis speciosus Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 48: Pomotis microlophus Giinther, i, 264: ?Xystroplites longimanus Cope, Proc. Amer. Phil. Soc. Phila. 1877, 65: Eupomotis holbrooki Jordan, Proc. U. S. Nat. Mus. ii, 1879, 224.)

#### 756. L. notatus (Agass.) McKay.

Body robust, elongate, the snout projecting, the profile searcely gibbons. Mouth rather wide, oblique, reaching the front of eye. Eye rather large. Opercular flap wide and rounded, shorter than in L. gibbosus, with a rather wide pale border all around. Scales very large; 4 rows on cheek. Spines rather high and strong, the longest dorsal spine as long as from muzzle past middle of pupil. Soft fins high. Gill-rakers short and not very stiff. Pharyngeal teeth paved. Color. pale olive, mottled; a faint dorsal spot. Head 3; depth  $2_8^4$ ; D. X, 11; A. III, 11; scales 4–35–13. L. 8 inches. Illinois to Alabama.

(Pomotis notatus Ag. Amer. Journ. Sci. Arts, 1854, 302: Enpomotis pallidus Jordan, Bull. U. S. Nat. Mus. x, 21, 1877; not Pomotis pallidus Agass.)

757. L. gabbosus (L.) McKay.—Common Sun-fish; Bream; Pumpkin-seed; Sunny.

Body short and deep, compressed, the profile steep, convex; usually an angle above the eye. Head rather small. Mouth small, oblique, the maxillary scarcely reaching the front of the eye. Dorsal spines rather high, as long as eye and snout; the soft rays higher. Pectorals

<sup>\*</sup> Gill & Jordan, Field and Forest, 1877, ii, 190: type Sparus aureus Walbaum = Perca gibbosa L. ( $\varepsilon v$ . well;  $\pi \tilde{\omega} \mu \alpha$ , opercle;  $\sigma v \varepsilon$ , ear.)

long. Scales large; 4 rows on cheek. Pharyngeal teeth all truncate, paved. Color greenish-olive above, shaded with bluish, the sides spotted and blotched with orange; belly orange-yellow; cheeks orange, with blue wavy streaks; lower fins orange, upper bluish and orange-spotted. Opercular flap rather small, the lower posterior part always bright scarlet, a mark which distinguishes this species when adult at once from all our other high-colored sun-fishes. Head 34; depth 2. D. X, 11; A. HI, 10; Lat. l. 47. L. 8 inches. Great Lake region to Maine and southward to Florida, east of the Alleghanies; found only in the northern parts of the Mississippi Valley. One of our most abundant and familiar fishes.

(Perca gibbosa L. Syst. Nat. ed. xi, 293, 1760 (after Perca fluriatilis gibbosa, ventre luteo, of Catesby): Sparus aureus Walb., Artedi. Pi.e. 1792, 290 (after "Goldfisch" of Schöpff): Pomotis vulgaris Cuv. & Val. iii, 91, 1829: Morone maculata Mitchill, Report, in part, Fish. N. Y. 1814, 18: Pomotis vulgaris Holbr. Ichth. S. Car. 8: Pomotis vulgaris Storer, Fish. Mass. 12: Pomotis auritus Günther, i, 261: Eupomotis aureus Jordan, Man. Vert. 241.)

## 758. L. lirus McKay.

"This species resembles P. incisor (L. pallidus) in the outline of the body, the nature and coloration of the scales, and in the size and form of the fins, but it differs greatly from it by its large mouth, the free extremity of the upper jaws reaching the vertical line of the middle of the eye, by the presence of teeth upon the palate, and by the ventral fins being placed immediately under the pectorals. The black opercular appendage, which is very short, has a narrow orange border behind; there is a black spot at the base of the posterior rays of the dorsal; both dorsal and anal are marked by one or two dark stripes; the candal is crossed by several dotted vertical lines; there are eight or nine dusky bars across the sides between the head and tail. This species bears the same relation to *Pomotis* that *Pomoxis* bears to the true Centrarchus in the size of the mouth and the form of the body, and I have no doubt it will some day become the type of a distinct genus." (Agassiz.) Tennessee River, at Huntsville, Ala. We are informed by Professor Bliss that the types of this species have the pharyngeals paved.

(Pomotis pallidus Agassiz, Amer. Journ. Sci. Arts, 1854, 303, not Labrus pallidus Mitch.; McKny, Proc. U. S. Nat. Mus. 1881, 89.)

## 251.-MICROPTERUS Lacépède.

Black Bass.

(Huro and Grystes Cuvier and Valenciennes: Calliurus, Dioplites, Lepomis, etc., Rafinesque.)

(Lacépède, Hist. Nat. Poiss. iv, 325, 1802: type Micropterus dolomieu Lac.)

Body elongate-ovate, compressed, the back not much elevated. Head oblong-conic. Month very large, oblique, the broad maxillary reaching nearly to or beyond the posterior margin of the eye, its supplemental bone well developed. Lower jaw prominent. Teeth on jaws, vomer, and palatines; usually none on the tongue. Preopercle entire; operculum ending in two flat points, without cartilaginous flap. Branchiostegals normally 6. Scales rather small, weakly etenoid. Lateral line continuous. Dorsal fin divided by a deep notch, the spines low and rather feeble, 10 in number; anal spines 3; the anal fin much smaller than the dorsal; candal fin emarginate. Size large. Two species, among the most important of American "game-fishes." (μετρος, small; πτερον, fin; the dorsal fin in the typical specimen having been injured, its posterior rays, detached and bitten off short, were taken by Lacépède for a separate fin.)

a. Mouth very large, the maxillary in the adult extending beyond the orbit; scales rather large, 65-70 in the lateral line; 7-8 series above lateral line.

**759. M. Salmoides** (Lac.) Henshall.—Large-mouthed Black Bass; Oswego Bass; Green Bass; Bayou Bass.

Body ovate-fusiform, becoming deeper with age, moderately com-Head large. Mouth very wide, the maxillary in the adult reaching beyond the eye; in the young shorter. Scales on the cheek in about 10 rows; scales on the trunk comparatively large. Lingual teeth sometimes present. Dorsal fin very deeply notehed. Coloration of the young dark-green above; sides and below greenish-silvery; a blackish stripe along the sides from opercle to the middle of the caudal fin; three dark oblique stripes across the cheeks and opercles; below and above the lateral band some dark spots; candal fin pale at base, then blackish, whitish at tip; belly white. As the fish grows older the black lateral band breaks up and grows fainter, and the color becomes more and more of a uniform pale dull green, the back being darker; a dark opercular blotch usually present. Head 34; depth 3. D. X, 13; A. III, 11; scales 8-68-16. L. 1-2 feet. Rivers of the United States, from the Great Lakes and Red River of the North to Florida and Texas; everywhere abundant, preferring lakes, bayous,

and sluggish waters. It grows to a larger size than the next species, and is readily distinguished by its coloration and the larger mouth and larger scales. Both species vary much with different waters,

(Labrus salmoides Lacépède, Hist. Nat. Poiss. iv, 716, 1802; Lepomis pallida Raf. Ichth. Oh. 30, 1820; Jordan, Ann. Lyc. Nat. Hist. xi, 314, 1877; Cichla floridana Le Suenr, Journ. Acad. Nat. Sci. Phila. 1822, 220; Huro nigricans C. & V. ii, 124; Huro nigricans Günther, i, 255; Micropterus nigricans Gill, Proc. Amer. Assoc. Adv. Sci. 1873, 70 (and of most late writers); Dioplites nuccensis Grd. U. S. Mex. Bound. Ichth. 3; Micropterus salmoides Henshall, Book of the Black Bass, 1881, 110.)

aa. Month smaller, the maxillary in the adult not extending beyond orbit; scales smaller, 72-75 in the lateral line; 10-12 series above the lateral line.

# 760. M. dolomien Lac.—Small-mouthed Black Bass.

Body ovate-fusiform, becoming deeper with age. Head large. Month large, but smaller than in M. salmoides, the maxillary ending considerably in front of the hinder margin of the orbit. Scales on the cheek minute, in about 17 rows; scales on the trunk comparatively small. Dorsal fin deeply notched, but less so than in M. salmoides, the ninth spine being about half as long as the longest, and not much shorter than the tenth. Coloration quite variable, the young dull golden green, with bronze lustre; darker spots along the sides, which tend to form short vertical bars, but never a dark lateral band; 3 bronze bands radiating from eye across cheeks and opercles; a dusky spot on point of operculum; belly white; candal fin yellowish at base, then black, with white tips; dorsal with bronze spots, its edge dusky. In some waters the finmarkings are obsolete, but usually they are very conspicuous in the young. Southern specimens usually have the scales of the lower part of the sides with faint dark streaks; adult specimens have all these marks more or less wholly obliterated, and become ultimately of a uniform dead green, without silvery lustre. Head 34; depth 34. D. X, 13; A. III, 10 or 11; scales 11-74-17. Rivers of the United States, from the Great Lake region to South Carolina and Arkansas; abundant, frequenting running streams, and preferring clear and cool waters; its southern limit is bounded by the presence of such waters. As a game fish this species is usually more highly valued than its congener.\*

(Lacépède, Hist. Nat. Poiss, iv, 325, 1802; Henshall, Book of the Black Bass, 1881, 84; Bodianus achigan Raf. Amer. Monthly Mag. & Crit. Rev. ii, 120, 1817; Grystes salmoides C. & V. iii, 54; Grystes salmonoides Günther, i, 252; Micropterus salmoides Gill, Proc. Amer. Assoc. Adv. Sci. 1873, 67, and of many American writers; Calliurus punctulatus Raf. 1chth. Oh. 26; Grystes fasciatus Günther, i, 258; Centravchus obscurus Günther, i, 258.)

<sup>\*</sup>Both this species and the preceding are popularly known in the Southern States by the grossly erroneous name of "Trout,"

# FAMILY LXXXV.—PERCIDÆ.

(The Perches.)

Body more or less clongate, terete or compressed, covered more or less completely with rather small, ctenoid, adherent scales. Lateral line usually present, not extending on the candal fin. Mouth terminal or inferior, small or large, the premaxillaries protractile or not; maxillaries large or small, without distinct supplemental bone. Jaws, vomer, and palatines with bands of teeth, which are usually villiform, but sometimes mixed with canines; occasionally the teeth on the vomer or palatines are absent. Head naked, or more or less scaly; preopercle entire or serrate; opercles usually ending in a flat spine. Branchiostegals 6 or 7. Gills 4, a slit behind the fourth; gill-membranes free or connected, not joined to the isthmus; gill-rakers slender, toothed; pseudobranchiæ small, or glandular and concealed, or altogether wanting; lower pharvngeals separate, with sharp teeth. Fins generally large; two dorsals, the first of 6 to 15 spines; anal fin with one or two spines (three in Percichthys, a fresh-water genus from Chili). Ventrals thoracic, I, 5; pectorals often very large; caudal lunate, truncate or rounded. Anal papilla often present. Air bladder small and adherent, often entirely wanting. Pyloric coeca few. Vertebrae, 30 to 45.

Genera about 22; species, 90 to 100; inhabitants of the fresh waters of cool regions, most of them being American and nearly all belonging to the fanna of the United States. The great majority of the species belong to the sub-family of Etheostomatina, the Darters, all the species of which group are American. They are among the most singular and interesting of our fishes. They differ from the typical Pereina in their small size, bright colors, and large fins, and more technically in the rudimentary condition of the pseudobranchiae and the air bladder, both of which organs are usually inappreciable. The preopercle is unarmed, and the number of branchiostegals is six. An anal papilla is likewise developed, as in the Gobiida, to which group the Darters bear a considerable superficial resemblance, which, however, indicates no real affinity. The relations of the Darters to the Perches have been aptly expressed by Professor S. A. Forbes:

"Given a supply of certain kinds of food nearly inaccessible to the ordinary fish, it is to be expected that some fishes would become especially fitted for its utilization. Thus the *Ftheostomatinæ* as a group

are explained in a word by the hypothesis of the progressive adaptation of the young of certain *Percidæ* to a peculiar place of refuge and a peculiarly situated food supply. Perhaps we may without violence call these the mountaineers among fishes. Forced from the populous and fertile valleys of the river beds and lake bottoms, they have taken refuge from their enemies in the rocky highlands, where the free waters play in ceaseless torrents, and there they have wrested from stubborn nature a meager living. Although diminished in size by their constant struggle with the elements, they have developed an activity and hardihood, a vigor of life and a glow of high color almost unknown among the easier livers of the lower lands. \* \* Notwithstanding their trivial size, they do not seem to be dwarfed so much as concentrated fishes." (Am. Nat. 1880, October, pp. 697–702.)

The colors of the Etheostomatina are usually very brilliant, species of Pacilichthys, Nothonotus, and Diplesium being among the most brilliantly colored fishes known; the sexual differences are often great, the females being as a rule dull in color and more speckled or barred than the males. Most of them prefer clear running water, where they lie on the bottom concealed under stones, darting, when frightened or hungry, with great velocity, for a short distance, by a powerful movement of the fan-shaped pectorals, then stopping as suddenly. They rarely use the caudal fin in swimming, and they are seldom seen moving or floating freely in the water like most fishes. When at rest, they support themselves on their expanded ventrals and anal fin. All of them can turn the head from side to side, and they frequently lie with the head in a curved position or partly on one side of the body. The species of Ammocrapts and perhaps some of the others prefer a sandy bottom, where, by a sudden plunge, the fish buries itself in the sand and remains quiescent for hours at a time, with only its eyes and snout visible. The others lurk in stony places, under rocks and weeds. Although more than usually tenacious of vitality, the Darters, from their bottom life, are the first to be disturbed by impurities in the water. All the Darters are carnivorous, feeding chiefly on the larva of Diptera, and in their way yoracious. All are of small size; the largest (Percina) reaches a length of 8 inches, while the smallest (Microperca) is probably the smallest spinyrayed fish known, barely attaining the length of an inch and a half. They are of too small size to be used for food, although, according to Rafinesque, "they are good to eat, fried."

The *Percinw* are represented in America by two genera, and in Europe by the same two and three others—*Acerina*, *Percarina*, and *Aspro*—the

latter bearing a strong external resemblance to the Etheostomatina, and serving as a connecting link between them and the more typical forms.

(Percida part, Günther, i, 58-78; genera Perca, Lucioperca, Pilcoma, Bolcosoma, Acerina, Percarina, Aspro, Percuchthys, and Percilia,)

- \* Anal spines one or two.
- a. Pseudobranchiæ imperfect or wanting; preopercle entire; branchiostegals 6. (Etheostomatina.)
  - b. Premaxillaries protractile.
    - e. Body extremely elongate, subcylindrical, translucent, the belly at least naked; lateral line complete; gill-membranes broadly united.
      - d. Anal spine single; anal fin nearly as large as second dorsal.

AMMOCRYPTA, 252.

- cc. Body less clongate, opaque, chiefly scaled.
  - e. Anal spine obscure, normally single.
    - f. Lateral line complete, or wanting on a few scales only. Boleosoma, 254,

  - ee. Anal spines two, the first commonly the longer.
    - q. Gill-membranes more or less broadly united; belly with ordinary scales.
    - gg. Gill-membranes scarcely connected.
      - i. Belly with enlarged cadneous plates ........... Cottogaster, 258.
      - ii. Belly without enlarged cadueous plates ..... Imostoma, 259.
- bb. Premaxillaries not protractile.
  - j. Lateral line complete.
    - k. Ventral line with a series of enlarged, spinous, eaducous scales or (if these are fallen) a naked strip.
      - l. Mouth small, inferior, beneath a pig-like snout.. Percina, 260.
      - Il. Mouth larger, the snout not projecting beyond it.

Alvordius, 261.

- kk. Ventral line without caducous scales.
  - m. Gill-membranes scarcely connected,
    - n. Anal fin larger than second dorsal Hadropterus, 262.
    - un. Anal fin smaller than second dorsal...Nothonorus, 263.
  - mm. Gill-membranes broadly connected ... NANOSTOMA, 264.
- ij. Lateral line present, incomplete.
  - o. Gill-membranes broadly united.... ETHEOSTOMA, 265.
  - oo. Gill membranes separate or nearly so.

Pecilicithys, 266,

- aa. Pseudobranchia well developed; preopercle serrate; branchiostegals 7. ( 'ereina.) p. Canine teeth none; body oblong......Perca, 238.
  - pp. Canine teeth in jaws and palatmes; body clongate.

STIZOSTEDIUM, 269.

#### 252.-ANINGCRYPTA Jordan.

#### Sand Darters.

(\* Pleurolepis Agassiz; not Pleurolepis Egerton, a genus of extinct Ganoids.)

(Jordan, Bull. U. S. Nat. Mus. x, 6, 1877: type Ammocrypta beani Jordan.)

Body slender and elongate, sub-cylindrical; pellucid in life.

<sup>\*</sup> Agassiz, Bull. Mus. Comp. Zoöl. i, 5, 1863; type Etheostoma pellucidum Baird MSS.

slender. Month rather wide, terminal, horizontal, the lower jaw included; premaxillaries very protractile; teeth on the vomer. Scales thin, etenoid, little imbricated, present along the region of the lateral line and on the tail, sometimes wanting on the back or belly; lateral line complete. Head scaly or naked; no ventral plates; the belly naked. Gill-membranes considerably united, forming an angle at their junction. Dorsal fins moderate, about equal to the anal fin and to each other; dorsal with about ten spines; anal spine single, weak. Vertebra 22 + 22 (A. pellacida). Darters of moderate or rather large size, inhabiting the sandy bottoms of clear streams, where they bury themselves entirely excepting the eyes and snout. Coloration translucent, with bright reflections. (apport, sand; zpozzos, concealed.)

a. Cheeks and opercles naked; body imperfectly scaled.

#### 761. A. beani Jordan.

Body greatly elongated, sub-cylindrical, transparent. Head rather large, heavier than in A. pellucida. Mouth rather wide, nearly terminal; the upper jaw somewhat the longer; outer teeth strong, hooked. Opercular spine obsolete. Head entirely naked. Body naked, except the caudal peduncle, which is sparsely covered with thin, imbedded scales, and a series of rather large scales along the sides, on which the lateral line runs. Dorsal fins high, wide apart, about equal in height to the anal fin and to each other; caudal fin emarginate. Color translucent, without bars or spots, the lateral line shining-golden in life. Spinous dorsal with a large black spot on the membrane anteriorly, another near the middle, and some small ones behind; other fins with their membranes dusted with dark points. Head 3\(^3\_4\); depth 7\(^1\_2\). D. X-10; A. I. 9; Lat. l. 65. L. 2\(^1\_2\) inches. Louisiana and Mississippi.

(Ammocrypta beanii Jordan, Bull, U. S. Nat. Mus. x, 5, 1877; Ammocrypta gelida Hay, Proc. U. S. Nat. Mus. 1880, 490—apparently the young; the size smaller and the fins lower.)

aa. Cheeks and opercles scaly.

# 762. A. pellucida (Baird) J. & G.—Sand Darter.

Translucent; scales with fine black dots; a series of small, squarish olive or bluish blotches along the back and another along each side; lateral spots connected by a gilt band. Body slender; head stout. Cheeks, opercles, and temporal region scaled; the scales imbedded and more or less cycloid. Neck above thinly scaled or naked; scales of body not very rough, those along lateral line and caudal pedancle most closely imbricated; belly entirely naked; opercle ending in a short, flat

spine. Maxillary barely reaching to opposite the large eye; eyes high up, separated by a narrow, grooved space. Pectorals short, reaching tips of ventrals, half way to vent. Head 4½; depth 7. D. X-10; A. I, 8; Lat. l. about 75, about 6 series of scales above it. L. 3 inches. Ohio valley and northwestward; abounding in clear sandy streams; one of the most interesting of our fishes.

(Etheostoma pellucidum Baird MSS.: Pleurolepis pellucidus Agassiz, Bull. Mus. Comp. Zoöl. i, 5, 1863: Pleurolepis pellucidus Vaillant, Recherches sur Etheostom. in Nouv. Archiv. Mus. 1874, 138: Pleurolepis pellucidus Jordan, Man. Vert. ed. 2, 219: Pleurolepis pellucidus Jordan & Copeland, Amer. Nat. 1877, 86.)

## 763. A. asprella Jordan.

Head long, rather slender. Eyes very large, high up and very close together. Month not large, sub-terminal, horizontal. Cheeks and opercles with pectinated scales. Opercular spine well developed. Squamation much more complete than in A. pellucida, the scales small and quite rough, largest posteriorly. Throat and belly naked, the space between the ventral fins scaled. Back of neck scaly. Fins large, the dorsals well separated; the spinous high, highest in front; second dorsal smaller, smaller than anal; anal spine high, flexible; caudal lunate. Coloration clear olivaceous, sides with 8 to 10 dark squarish blotches, quite small and far apart; a blackish shade forward from eye, and a dusky shade across opercle. Said to present in life "almost all the colors of the rainbow." Head  $4\frac{1}{6}$ ; depth 8. D. IX-10; A. I, 8; Lat. l. 98, ten series above the lateral line. L. 4 inches. Illinois to Alabama, in sandy streams; a much larger and rougher species than the preceding.

(Pleurolepis asprellus Jordan, Bull. Ills. Lab. Nat. Hist. 2, 38, 1875: Pleurolepis asprellus Jordan, Man. Vert. ed. 2, 404.)

#### 253 .- IOA Jordan & Brayton.

(Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 88, 1878: type Pacilichthys ritreus Cope.)

This genus differs from Ammocrypta chiefly in the presence of two well-developed spines in the anal fin. The anal fin is proportionately smaller, and the scales are larger and rougher, more fully covering the body. The squamation of the head is more complete than in any other genus. Species slender, translucent in life. (los, an arrow or dart.)

## 764. I. vitrea (Cope) J. & B.

Form of Ammocrypta. Head slender, acuminate; mouth not very small; temporal region scaled; cheeks and opercles covered with large, imbricated, very roughly etenoid scales, these scales extending forward to the maxillary and backward to edge of opercle and on subopercle;

the feeble opercular spine is almost hidden by them. Middle and lower part of the sides of the body covered with large, imbricated, very rough scales, these less closely set below; breast naked; behind the ventrals the middle line of the belly with some small scales, behind which is a naked space bounded by small imbedded scales, and extending as far as the vent; back from middle of first dorsal forward naked, posteriorly more or less scaly. Fins low and small, the second dorsal larger than the first or the anal; the spines slender; anal spines short; pectoral fins long and narrow. Translucent, with small dark spots on back and sides, besides finer specklings; fins plain. Head 4½; depth 7. D. VII to IX-II to 13; A. II, 6 to 8; Lat. 1, 60. L. 2 inches. Nense River, North Carolina; locally abundant.

(Pacilichthys ritrens Cope, Proc. Amer. Philos. Soc. Phila, 1870, 263; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 82, 1878.)

## 254.—BOLEOSOMA DeKay.

## Tessellated Darters.

(Arlina and Estrella Grd.)

(DeKay, New York Fauna Fish, 1842, 20: type Bolcosoma tessellatum DeKay = Etheostoma olmstedi Storer.)

Body moderately clongate, fusiform, not translucent. Head small, narrowed forwards, the profile convex. Mouth small, horizontal, the lower jaw included; premaxillaries protractile. Maxillary not adnate to preorbital. Vomerine teeth present. Scales large. Lateral line continuous (rarely wanting on two or three scales). Belly with ordinary scales. Gill-membranes narrowly connected. Dorsal spines 7–10, slender; soft dorsal much larger than anal; anal normally with a single, short, slender spine, the first soft ray simple, but articulate. Vertebrae (B. nigrum) 17 + 20. Coloration olivaceous and speckled, the males blackish in spring. Size small. (30 $\lambda \epsilon_5$ , a dart;  $\sigma \delta \rho \mu a$ , body.)

- a. Dorsal spines normally 9,
  - - c. Body fusiform, with slender candal peduncle; fins moderate; second dorsal with 11 or 12 rays; lateral line usually not quite complete......nigrum.
       ce. Body robust, compressed; fins very high.

- a. Dorsal spines normally 9.
  - b. Cheeks scaly; second dorsal with 13 or 14 rays.

## 765. B. olmstedi (Storer) Agassiz.

Body slender, little compressed, with long caudal peduncle. Head slender, rather pointed. Cheeks and opercles scaly; space before dorsal naked; breast naked. Fins very high, pectorals reaching past tips of ventrals. Coloration olivaceous, tessellated above; sides with blotches and zigzag markings; fins speckled or somewhat barred; head not speckled, dusky in males; usually a black stripe forward from the eye and another downward. Head 4; depth 5½. D. IX-14; A. I, 9; Lat. 1. 50. L. 3½ inches. Great Lakes to Georgia and Massachusetts; the commonest eastern species. A southern form, var. maculaticeps, has the cheeks scaly above only, and is more speckled; var. atromaculatum, found eastward, has the breast closely scaled.

(Etheostoma olmstedi Storer, Bost. Journ. Nat. Hist. 1842, 61: Bolcosoma tessellatum DeKay, New York Fauna Fish. 1842, £0; Agassiz, Lake Superior, 299; Güuther, i, 77; Cope, Journ. Acad. Nat. Sci. Phila. 1868, l213; Vaillant, I. e, 79: Bolcosoma maculaticeps Cope, Proc. Amer. Philos. Soc. 1870, 269: Estrella atromaculata Girard, Proc. Acad. Nat. Sci. Phila. 1859, 66.)

- bb. Cheeks and breast (normally) naked.
  - d. Body fusiform, with slender caudal peduncle; fins moderate; second dorsal with 11 or 12 rays; lateral line usually not quite complete.

#### 766. B. missing (Raf.) Jor.-Johnny Darter.

Body fusiform, slender. Head conical, moderate, the snort somewhat deenryed. Month small, lower jaw included. Cheeks and breast naked (specimens occasionally found with these regions closely scaly); opercles scaly; space before dorsal mostly scaled. Fins high, but smaller and lower than in the other species. Coloration pale olivaceous; back much tessellated with brown; sides with numerous small W-shaped blotches; head speckled above, mostly black in the males; a black line forward from eye, and sometimes a line downward also; fins barred; males in the spring blackish anteriorly, sometimes almost Tubes of the lateral line obsolete on the last 4 or 5 entirely black. scales. Head 41; depth 5. D. IX-12; A. I, 8; scales 5-51-9. L. 21 Ohio Valley, Great Lake region, and Upper Mississippi; very inches. abundant where found. It perhaps varies into B. olmstedi, but may be distinguished, as far as we have seen, by the shorter dorsal.

(Etheostoma nigra Raf. Ichth. Oh. 1820, 37: Boleosoma maculatum Agassiz, Lake Superior, 1850, 305: Boleosoma breripinne Cope, Proc. Amer. Philos. Soc. 1870, 268; Günther, i, 77: Boleosoma mutatum Vaillant, l. c. 88: ? Pacilichthys mesans Cope, Proc. Acad. Nat. Sci. Phila. 1834, 232: Boleosoma maculatum Jordan, Man. Vert. ed. 2, 224.)

dd. Body robust, compressed; fins very high.

e. Second dorsal with 13 rays; lateral line about 40.

## 767. B. effulgens (Grd.) Cope.

Body rather slender; candal peduncle not contracted; opercular spines rudimental; muzzle abruptly decurved. Eye 3\frac{3}{4} in head. Fins very high; candal very much rounded; ventrals reaching anal; pectorals still longer. Color brown, with traces of nine spots on the side; muzzle, chin, and spot below the eye black; fins black, the second dorsal and caudal with white specks. Head 4\frac{1}{5}; depth 6\frac{1}{4}. D. 1X-13; A. H. 8; scales 5-40-6. L. 2\frac{3}{4} inches. Maryland to North Carolina. (Copc.)

(Arlina effulgens Girard, Proc. Acad. Nat. Sci. Phila, 1859, 64; Cope, Proc. Am. Philos. Soc. 1870, 269.)

ee. Second dorsal with 10 rays: lat. l. about 35.

#### 768. E. vexillare Jordan.

Body rather short and stout; caudal pedancle not contracted; opercular spine moderately developed; space in front of dorsal fin naked; muzzle moderately decurved; eye moderate. Second dorsal very high, higher than long; pectorals and ventrals long, nearly reaching anal. Coloration olivaceous, the sides with traces of vertical bars; first dorsal, ventrals, and anal black; second dorsal and candal strongly barred with pale in fine pattern; head black in the male; lateral line complete. Head 4; depth  $4\frac{2}{3}$ . D. VIII-10; A. I, 7; scales 4-35-6. L.  $2\frac{1}{4}$  inches. Rappahannock River, Warrenton, Va.; a single specimen known.

(Jordan, Proc. U. S. Nat. Mus. 1880, 237.)

aa. Dorsal spines 7.

#### 769. B. msopus Cope.

Body stout, the back rather elevated; the caudal peduncle somewhat contracted; muzzle somewhat decurved; mouth terminal. Dorsal fins much elevated. Color light brown, with six small dark dorsal spots, and ten similar small spots along the dorsal line; a bar around muzzle and one below eye. D. VII-14; A. 10; scales 5-47-8. L. 2½ inches. Loyalsoc Creek, a tributary of Allegheny River. (Cope.) One specimen known, perhaps an accidental variation.

(Cope, Proc. Am. Philos. Soc. Phila. 1870, 270.)

#### 255 .- VAHLLANTIA Jordan.

(Jordan, Ball. U. S. Nat. Mus. xii, 89, 1878; type Bolcosoma camurum Forbes.)

This genus agrees with *Bolcosoma* in all respects, except that the lateral line is incomplete, usually ceasing near the middle of the body. (To Léon Vaillant, author of an excellent monograph of these fishes.)

## 770. V. camura (Forbes) Jor.

Body slender, elongate, with long caudal peduncle. Back somewhat Head small, rather slender, the snout shorter than eye, strongly decurved. Mouth inferior, horizontal, small, the maxillary extending to the middle of the eve. Gill-membranes little connected. Cheeks, opercles, and breast closely covered with rather large scales; median line of neck naked; opercular spine strong; scales moderate; lateral line quite short, nearly straight, reaching to the middle of the spinous dorsal, developed on 20 to 30 scales. Fins small, the dorsals well apart; first dorsal larger than the second, which is larger than the small anal. Coloration as in Bolcosoma, olivaceous, the back spotted and tessellated; sides with about ten irregular spots; a dark spot on opercles. Head spotty above: a black line across the muzzle: no bar below eye; dorsals and caudal fin finely barred. Head 41; depth 51. D. X-10; A. I. 8; scales 5-56-10. L. 21 inches. Rivers of Illinois.

(Bolcosoma camura Forbes, Bull. IIIs. Lab. Nat. Hist. ii, 40, 1878.)

#### 771. V. chlorosoma Hay.

Body slender, compressed, the dorsal region much arched. Caudal peduncle long and slender, the body abruptly contracted at the vent. Head small, convex in profile. Cheeks and opercles scaled. Breast scaled or naked. Dorsals separated by a distance equal to half the head, about equal to each other, larger than the anal. Lateral line developed on 4 to 20 scales. Greenish yellow, with many blotches and zigzag markings of brown; a row of about 10 of these blotches along each side, most distinct on caudal peduncle; about 8 square brown dorsal spots. Top of head, opercular spot, and subocular spot, black. A black streak from eye to snout. Head 4½; depth 5¼. D. IX-11; A. I, 7 or I, 8; Lat. 1 50 to 60. L. 2 inches. Eastern Mississippi; apparently not different from the preceding.

(Hay, Proc. U. S. Nat. Mus. 1880, 495.)

#### 256.-ULOCENTRA Jordan.

(Jordan, Man. Vert. E. U. S. ed. 2, 223, 1878; type Arlina atripiunis Jor.)

Body moderately elongate, little compressed. Head short, thick, with tumid cheeks. Mouth small, horizontal, the lower jaw included. Premaxillaries protractile, little movable; maxillary movable, not joined to the preorbital except at its root; vomerine teeth present, small. Gill-membranes more or less broadly connected. Scales moderate. No ventral plates. Lateral line complete or incomplete. First dorsal with 12

spines; anal smaller than second dorsal, with two well-developed spines, the first the longer. Small species, rather brightly colored. (συλος, complete; χεντρον, spine; the development of the anal spines distinguishing it from Boleosoma.)

a. Lateral line incomplete.

## 772. U. phlox (Cope) J. & G.

Vermillion red, with faint small brown dorsal spots; a series of similar blue spots along the lateral line. Spinous dorsal with a dark blue border; second dorsal with a dark shade; caudal cross-barred. Body rather stout. Head compressed. Mouth terminal, the premaxillaries freely protractile; opercular spine strong. Cheeks and opercles naked. Breast and neck scaleless or nearly so. Scales rather large, the belly scaled like the sides. Gill-membranes not described. Lateral line straight, reaching middle of second dorsal. Anal fin small, other fins large. D. X-12; A. H. 5; scales 5-52-8. L. 2 inches. Trinity River, Texas. (Cope.) (Bolcosoma phlox Cope, Bull. U. S. Nat. Mus. xvii, 30, 1880.)

## 773. U. stigmæa Jordan.—Speck.

Body slender, formed as in *Bolcosoma*. Head narrow and thin, the snont somewhat pointed, obliquely truncate in profile. Mouth narrow, horizontal, subinferior, its cleft nearly reaching eye; premaxillaries little protractile. Lateral line extending to opposite middle of second dorsal. Scales rather large. Opercles, cheeks, and neck scaly; breast naked. Gill-membranes not very broadly joined; opercular spine sharp. Fins rather large; caudal emarginate. Olivaceous, tessellated and speckled above; sides with about 8 W shaped dark green blotches below the lateral line and various duller ones above; upper parts in the larger specimens sprinkled with small orange spots, which are more conspicuous after death, when the green has faded. Fins mottled; spinous dorsal with a band of orange-red above, and one or two narrow dark ones below it. A dark stripe forward and another downward from eye. Head 4½; depth 5. D. X-12; A. II, 7; scales 5-46-7. L. 2½ inches. Georgia to Louisiana; rather common in the ponds and streams of the hill country.

aa. Lateral line complete.

#### 774. U. atripinnis Jordan.

Body rather short, somewhat compressed behind. Head extremely short and deep, the shout very short and abruptly rounded, as in *Diplesium*. Eye large. Month small, with equal jaws. Cheeks and oper-

( Eoleosoma stigmaum Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 311.)

cles scaly; the cheek scales small and closely set; a triangular series of scales on temporal region; throat smooth; neck above closely scaly; belly closely scaled. Fins large; spinous dorsal high, the second still higher, but smaller than the first, its base about equal to the length of the head; dorsal fins contiguous, slightly connected. Color olivaceous; head above entirely black; back with 8 dark crossbars; about 11 bar-like blotches, somewhat indistinct, arranged along the lateral line; fins chiefly black; membranes of the second dorsal and ventral fins entirely black, that of the spinous dorsal with a broad black horizontal bar at base, above which are numerous distinct black oblique streaks; anal with a broad black bar; caudal and pectoral fins largely dusky. Females and young probably paler. Head  $4\frac{1}{8}$ ; depth  $4\frac{1}{2}$ . D. XII-10; A. II, 7; Lat. l. (not counted). L.  $2\frac{1}{2}$  inches. Cumberland River; but one specimen known.

(Arlina atripinnis Jordan, Bull. U. S. Nat. Mus. 1877, 10; Jordan, Man. Vert. ed. 2, 223.)

## 775. U. simotera (Cope) Jordan.

Body short and rather deep. Head small; the snout very obtuse, as blunt as in *Diplesium*. Cheeks, opercles, and breast scaly. Dorsal fins well separated. Back and sides each with a series of quadrate blackishgreen blotches; belly saffron-color; upper parts sprinkled with red spots; first dorsal margined with orange-red; a row of oval red spots across the middle of the fin; second dorsal with the membrane chiefly blood-red; a black spot on occiput and opercle; a dark stripe downward and one forward from eye; caudal fin brown, barred. Head 5; depth 4. D. X-11; A. H, 7; scales 10-52-12. L. 3 inches. Headwaters of the Tennessee and Cumberland rivers; an elegant and peculiar species, carrying to an extreme the gobioid appearance of these fishes.

(Hyostoma simoterum Cope, Journ. Acad. Nat. Sci. Phila, 1868, 215: Hyostoma simoterum Vaillant Recherches, 100: Diplesium simoterum Jordan, Man. Vert. ed. 2, 223.)

#### 257.-DIPLESIUM Rafinesque.

(Hyostoma Agassiz.)

(Diplesion Rafinesque, Ichth. Oh. 1320, 37; type Etheostoma blennioides Raf.)

Body elongate, subterete. Head very short and blunt, with tumid cheeks; the profile very convex. Mouth small, inferior, horizontal. Premaxillaries protractile, little movable, joined to the forehead mesially by a slight frenum; maxillary not protractile, adnate for most of its length to the fleshy skin of the preorbital; lower jaw very short; teeth

in jaws strong; no teeth on vomer or palatines. Gill-membranes broadly connected. Scales moderate, rough. Lateral line complete; no enlarged ventral plates. Dorsal fins large, the spinous dorsal longer and lower than the second, of about 13 spines; anal smaller than second dorsal with 2 strong spines. Vertebra (D. blennioides) 19 + 22. Coloration largely green. ( $\delta i_5$ , two;  $\pi \lambda \delta \sigma i \nu \nu$ , near; dorsal fin nearly divided in two.)

## 776. D. blennioides (Raf.) Jor.—Green-sided Darter.

Body stout, elongate, little compressed; profile very convex. Eyes large, high up and close together; a longitudinal furrow between the eyes. Mouth small, horizontal, quite inferior; upper jaw concealed in a furrow under the snout. Scales moderate; those on the belly large, not caducous; cheeks with fine scales; opercles with large ones; neck scaly; chest naked. Anal papilla very large. Anal spines strong; caudal fin emarginate; lower rays of the pectorals, and the rays of the ventrals and anal enlarged and fleshy in the males. Color olive green, tessellated above; sides with about eight double transverse bars, each pair forming a Y-shaped figure; these are sometimes joined above, forming a sort of wavy lateral band; in life these markings are of a clear deep green; sides sprinkled with orange dots; head with olive stripes and the usual dark bars: first dorsal dark orange brown at base, blue above, becoming pale at tip; second dorsal and anal of a rich blue green, with some reddish; caudal greenish, faintly barred; young and female specimens are more or less dull, but the pattern is peculiar. Head  $4\frac{1}{3}$ ; depth  $4\frac{3}{4}$ . D. XIII-13; A. II, 8; Lat. l. 65 to 78. L. 3-5 inches. Pennsylvania to Kansas, south to Alabama; one of the handsomest and most abundant of the Darters.

(Etheostoma blennioides Raf. Journ. de Physique, 1819, 419: Pileoma cymatogramma Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 327: Hyostoma cymatogrammum Vaillant, l. c. 102; Jordan, Man. Vert. 222: Hyostoma blennioperea Cope (Journ. Acad. Nat. Sci. Phila. 1868, 214) is a form larger than usual and with rather smaller scales: Hyostoma newmani Agassiz (Am. Journ. Sci. Arts, 1854, 305) is slenderer, with rather larger scales on the body and on the checks. Both grade into the common form.)

## 258.—COTTOGASTER Putnam.

(Rheocrypta Jordan.)

(Putnam, Bull. Mus. Comp. Zoöl. 1863, 5: type Bolcosoma tessellatum Thompson, not of DeKay.)

Body rather robust, little compressed. Head moderate, bluntish. Mouth small, the lower jaw included; premaxillaries protractile; maxillary not adherent to the preorbital. Teeth on vomer. Gill-membranes nearly separate. Scales ctenoid; those of the middle line of the belly

Bull. Nat. Mus. No. 16-32

enlarged and spinous, falling off at times, leaving a naked strip; lateral line continuous. Dorsal fins large, the second usually smaller than the first and smaller than the anal. Anal spines two, strong, the first the longer. Size moderate.

(ποττος, sculpin; γαστήρ, belly.)

## 777. C. copelandi Jordan.

Body rather slender and elongate. Head rather large and long, somewhat narrowed, resembling that of *Boleosoma*. Mouth small, horizontal, subinferior. Eye large,  $3\frac{1}{3}$  in head. Cheeks naked; opercles and neck each with a few scales; throat naked. Ventral plates well developed; scales moderate, strongly ctenoid. Color brownish olive; a series of rather small, horizontally-oblong, black blotches along the lateral line, forming an interrupted lateral band; back tessellated; blackish streaks forward and downward from eye; ventral fins dusky in the male; vertical fins with dusky specks; a black spot on anterior rays of spinous dorsal. Head  $4\frac{1}{4}$ ; depth  $5\frac{1}{2}$ . D. XI-10; A. II, 9; Lat. 1. 56. L.  $2\frac{1}{2}$  inches. White River, Indiana; abundant near Indianapolis.

(Rheocrypta copelandi Jordan, Bull. U. S. Nat. Mus. X, 9, 1877: Rheocrypta copelandi Jordan, Man. Vert. 222.)

## 778. C. putnami J. & G. (nom. sp. nov.).

General form of the preceding. Month large, the maxillary reaching to the pupil. Snout convex. Cheeks naked; opercles closely scaled; chest naked; neck above scaly; scales large. Tessellated above; sides with ten square blotches, which are small and slightly connected by a dusky band; spinous dorsal with a brown median band; second dorsal and caudal barred; entral in the males dusky; a dusky stripe down ward and one forward from eye. Head 4; depth 6. D. XI-11; A. II, 8; Lat. 1. 44. L. 3 inches. Lake Champlain. (Described from No. 1314, U. S. Nat. Mus.)

(Boleosoma tessellatum Thompson, Appendix Hist. Vermont, 1853, 31; not of Dekay: Cottogaster tessellatus Putnam, Bull. Mus. Comp. Zool. 1863, 5.)

## 259.—IMOSTOMA Jordan.

(Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 49: type Hadropterus shumardi Grd.)

Body robust. Head large. Mouth comparatively large, horizontal, the lower jaw included; premaxillaries protractile; maxillary not adnate to preorbital. Belly without caducous plates. Fins as in *Alvordius*, the anal larger than the second dorsal. ( $\varepsilon\iota\mu\iota$ , to move;  $\sigma\tau\delta\mu\alpha$ , mouth.)

## 779. I. shumardi (Grd.) Jordan.

Body stout, heavy forward, compressed behind. Head broad and

0 .

thick. Eye large,  $3\frac{1}{2}$  in head. Month large and broad, the lower jaw wide, a little shorter than the upper; maxillary reaching to the eye. Checks, opercles, and neck scaly; chest naked; belly naked anteriorly, scaly for a distance in front of the vent; scales rather large. Dorsal fins large, the first larger than the second, which is smaller than the anal, though longer; the two dorsal fins well separated; anal fin large, very deep, in some specimens (males?) reaching to the caudal; anal spines strong, the first the larger. Color dark, densely but vaguely blotched with darker; sides with 8-10 obscure blotches, the anterior ones bar-like; a large black spot on base of spinous dorsal behind, and a small one in front; second dorsal, caudal, and pectorals barred; a very strong black suborbital bar, and a faint dark line along muzzle. Head  $3\frac{2}{5}$ ; depth 5. D. X-15; A. II, 11; scales 6-56-11. L. 3 inches, Wabash, Illinois, and Arkansas Rivers. (Hadropterus shumardi Girard, Proc. Acad. Nat. Sci. Phila. 1859, 100; Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 49; Jordan, Man. Vert. 222.)

#### 260.-PERCINA Haldeman.

Log Perches.

(Pilcoma DeKay.)

(Haldeman, Journ. Acad. Nat. Sci. Phila. viii, 330, 1842: type Perca nebulosa Hald. = Sciana caprodes Raf.)

Body elongate, slightly compressed, covered with small etenoid scales. Lateral line continuous; ventral line with enlarged plates, which fall off, leaving a naked strip. Head depressed, rather pointed, the month being small and inferior, overlapped by a tapering, subtruncate, pig-like snout; upper jaw not protractile. Teeth on vomer and palatines. Giil-membranes scarcely connected. Dorsal fins well separated, the first the larger, of 13–15 spines; the second dorsal rather longer than the anal, which has two spines, the first of which is usually the shorter. Air-bladder and pseudobranchiæ present, rudimentary. Vertebræ ( $P.\ caprodes$ ) 19+22. General pattern of coloration olivaceous, with dark vertical bands alternately long and short. (A diminutive of Perca.)

# 780. P. caprodes (Raf.) Grd.—Log Perch; Rock-fish; Hog-molly; Hog-fish.

Body elongate, compressed. Head long and pointed, depressed and sloping above. Mouth small, quite inferior, the maxillary not reaching nearly to the front of the eye. Cheeks, opercles, and neck scaly; chest naked. Fins rather low. Color yellowish green, with about 15 transverse dark bands from the back to the belly, these usually alternating with shorter and fainter ones, which reach about to the lateral

line; a black spot at the base of the caudal; fins barred. Head 4; depth 6. D. XV-15; A. II, 9; Lat. 1. 92. L. 6-8 inches. Great Lakes and streams of the South and West; the largest of the darters.

(Sciana caprodes Rafinesque, Amer. Month. Mag. 1818, 534: Pileoma semifasciatum DeKay, New York Fanna Fish. 1842, 16: Etheostoma caprodes, nebulosa, semifasciata, and bimaculata Storer, Synop. Fish. N. A. 270-272; Girard, Proc. Acad. Nat. Sci. Phila. 1859, 66: Pileoma semifasciatum Günther, i, 76: Pileoma caprodes Vaillant l. c. 43; Jordan, Man. Vert. 220: Pileoma carbonaria Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 387: Pileoma carbonaria Günther, i, 76: Pileoma carbonaria Girard, 1859, 10: Percina carbonaria Girard, Proc. Acad. Nat. Sci. Phila. 1859, 67; the latter a variety from Texas with the fins mostly higher.)

#### Var. maniton Jordan.

Space in front of spinous dorsal naked; lateral bars short, more or less confluent, each one not meeting its fellow of the other side across the back; otherwise essentially as in the preceding, with which it intergrades. Chiefly northwestward; abundant in Wisconsin. Examples intermediate between caprodes and manitou from Potomac River (Bean; Jouy) and Illinois (Forbes).

(Percina manitou Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 53.)

#### 261.—ALVORDIUS Girard.

## Black-sided Darters.

(Ethcostoma Agassiz; not of Rafinesque.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 68: type Alvordius maculatus Girard.)

Body rather elongate, little compressed. Mouth rather wide, terminal, the lower jaw included, the snout above not protruding beyond the premaxillaries, which are not protractile. Teeth on vomer, and usually on palatines also. Gill-membranes separate. Scales small, etenoid, covering the body. Belly with a median series of enlarged spinous plates, which fall off, leaving a naked strip; sides of head scaly or not. Lateral line complete. Fins large, the soft dorsal smaller than the spinous or the anal. Anal spines 2; dorsal spines 10–15. Vertebre 22 + 22 (A. aspro); 17 + 22 (A. evides). Coloration bright; sides with dark blotches. The most active and graceful of the darters.

(Dedicated to Maj. B. Alvord, who discovered "Alvordius maculatus" at Fort Gratiot, on Lake Huron.)

- Vertebræ more than 40; dorsal spines 11 to 15; palatine teeth present. (Alvordius.)

  - bb. Cheeks covered with fine scales; opercles with larger ones.
    - c. Head very slender, with long acuminate muzzle; jaws nearly equal; space before dorsal scaled; lat. l. 65-70; lateral blotches small, quadrate.

phoxocephalus

cc. Head stouter, with wider muzzle; lower jaw included ...... aspro, nevisensis.

- bbb. Cheeks naked; opercles scaly above only; space before dorsal naked; muzzle blunt.
- aa. Vertebræ less than 40; dorsal spines 10 or 11; palatine teeth obsolete; males with the lower fins tuberculate in spring. (Ericosma Jordan.)...evides, fasciatus.
- a. Vertebræ more than 40; dorsal spines 11 to 15; palatine teeth present. (Alrordius.)
   b. Cheeks and opercles entirely scaleless; head very long and large; lat. 1. 75 to 80.

## 781. A. macrocephalus (Cope) Jor.

Body elongate. Head long and large; mouth rather large, maxillary reaching to opposite anterior margin of orbit. Eye shorter than snout, 4½ in head. Ventral shields twice as large as other scales. Head, neck, and chest without scales. Color light brown, with a slightly undulating whitish band from upper angle of opercle to candal pedancle; back with dark quadrate spots; sides with 9 blackish longitudinal spots, alternating with smaller ones; streaks downward and forward from eye; vertical fins somewhat barred; spinous dorsal with a median blackish band; head spotted above. Head 3½; depth 7. D. XV-13; A. H, 11; scales 11-77-15. L. 3 inches. Ohio Valley; not very common. (Etheostoma macrocephalum Cope, Trans. Am. Philos. Soc. 1866, 401; Jordan, Man. Vert. ed. 2, 220.)

- bb. Cheeks covered with fine scales; opercles with larger ones.
  - c. Head very slender, with long acuminate muzzle; jaws nearly equal; space before dorsal scaled; lat. l. 65 to 70; lateral blotches small, quadrate.

#### 782. A. phoxocephalus (Nelson) Cope & Jordan.

Body rather slender, compressed. Head extremely long, narrow and tapering, the snout very acuminate. Mouth large, the maxillary reaching to the eye; the lower jaw unusually narrow and long, scarcely shorter than upper. Eye about equal to snout,  $4\frac{1}{4}$  in head. Cheeks, opercles, and neck with small scales; chest naked. Color yellowish brown, somewhat as in A. aspro, but the lateral spots smaller and more numerous, quadrate in form; a small blackish spot at each end of the lateral line. Head 4; depth  $5\frac{1}{2}$ . D. XII-13; A. II, 9; scales 12-68-14. L. 4 inches. Indiana to Kansas; not common.

(Etheostoma phorocephalum Nelson, Bull. Ills. Mus. Nat. Hist. i, 35, 1876; Jordan, Man. Vert. Ed. 2d, 221.)

cc. Head stouter, with wider muzzle; lower jaw included.

#### 783. A. aspro Cope & Jordan—Black-sided Darter.

Body rather elongate, fasiform, compressed behind. Head moderately elongate, less pointed than in some of the species. Mouth moderate, the lower jaw included; maxillary reaching just past the front of the eye. Eye about equal to snout, 4 in head. Gill-membranes little con-

nected. Lateral line straight, prolonged forwards to the eye. Opereles with rather large scales; cheeks covered with very small ones, which are scarcely visible; breast naked; neck naked, or more or less scaly; body otherwise entirely scaly, the scales small and rough. Straw-yellow or greenish, with dark tessellations and marblings above, and about 7 large dark blotches along the sides, which are partly confluent, thus forming a moniliform band; fins barred. Head 4; depth 6. D. XIII to XV-12; A. II, 9; scales 9-65-17. Ohio River to the Upper Missouri, chiefly northward; one of the most curious and elegant of the darters. Its coloration varies much in intensity with differences in surroundings. Specimens from the Ohio Valley slenderer than the typical form, with narrower head, scaly neck and paler colors, form a slight variety approaching A. phoxocephalus.

(Etheostoma blennioides Kirtland, Bost. Journ. Nat. Hist. 1839, 340—not of Rafinesque: Etheostoma blennioides Vaillant, l. c. 57; Cope & Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 51: Alrordius maculatus Jordan, Man. Vert. ed. 2, 220, probably not of Girard, who describes the head as scaleless.)

## 784. A. nevisensis (Cope) Jor.

"This is an elongate fish, with muzzle obtuse in profile, as well as wide, viewed from above. Cheeks, operculum, and middle dorsal line scaled. Ventral line without spinous scales; one only being present in the symphysis of the 'coracoids'. Anal fin with base a little shorter than spinous dorsal; the species may really be a Pacilichthus. First dorsal moderately elevated; second, peculiar in spinous ray, well separated from the first dorsal. Caudal fin slightly forked. Ground color above yellowish, crossed by 9 dark chestnut quadrate spots on the median line, which are wider than their interspaces and are connected at their ends by an undulate chestnut band. Below the latter a similar longitudinal band on the anterior half of the body. Six quadrate black spots on the sides, with a small spot between each. A dark band from end of muzzle to scapula; below it on operculum, a silver spot. A black bar below eye. Belly white. Caudal and second dorsal distinctly, pectoral and ventral faintly black barred. A series of black spots along middle of first dorsal." Head 41; depth 44. D. XIII-I, 12; A. II, 8; scales 8-53-L. 31. (Copc.) Maryland to North Carolina.

(Hadropterus maculatus\* Grd, Proc. Acad. Nat. Sci. Phila. 1859; not Alv. maculatus Grd.: Etheostoma nevisense Cope, Proc. Amer. Philos. Soc. Phila. 1870, 231.)

bbb. Cheeks naked; opercles scaly above only; space before dorsal naked; muzzle blunt.d. Ventral shields moderate; colors dull, plain.

<sup>\*</sup>The types of this species, lately examined by us, seem to be identical with A. nevisensis; cheeks with rather large scales; middle of breast with scales; ventral plates large. Scales 7-56-12. D. XIV-12; A. II, 9. Maryland.

### 785. A. crassus Jordan & Brayton.

Body stouter and more compressed than in *A. aspro*. Head stout; mouth as in *A. aspro*, the maxillary reaching front of eye. Onter teeth slightly enlarged. Cheeks entirely naked; opercles scaly; breast and anterior part of neck scaleless; ventral shields moderate. Coloration essentially as in *A. aspro*, the blotches rather faint and band-like. Depth 5; head 4. D XI-12; A. II, 8; scales 7-54-7. L. 3-4 inches. Rivers of North and South Carolina.

(Etheostoma maculatum var. Cope, Proc. Acad. Nat. Sci. Phila. 1870, 261 (not Hadropterus maculatus Grd.); Jordan & Brayton, Bull. xii U. S. Nat. Mus. 1878, 12.)

dd. Ventral shields very large, 4 or 5 times the size of the ordinary scales; colors brilliant.

### 786. A. variatus (Kirt.) Jor.

Body moderately elongate; deeper than in A. aspro. Head rather short and stout. Mouth large, the maxillary reaching the eye; lower jaw scarcely shorter than upper; outer teeth somewhat enlarged. Eyes moderate, about as long as snout, 3½ in head. Head naked, with the exception of a few scales on the upper anterior part of the opercle; neck and breast scaleless. Ventral shields larger than in any of the other species; four times as large as the other scales, 6 to 8 in number, with strong radiating points. Coloration bright olive, the back with short brown cross bars; the sides with broad brownish shades; black blotch on neck and on opercle; blackish bars downward and forward from eye; fins barred, the spinous dorsal with a black band. According to Dr. Kirtland, the males are further variegated with blue, green, and orange. Head 3¾; depth 5. D. XII-12; A. II, 8; scales 7-53-9. Ohio and Pennsylvania.

(Itheostoma variatum Kirtland, Bost. Journ. Nat. Hist. 1840, 274: Etheostoma pellaum Stanffer MSS. Cope, Proc. Acad. Nat. Sci. Phila. 1854, p. 233:? Alvordius maculatus Girard, Proc. Acad. Nat. Sci. Phila. 1859, 68: Etheostoma pellatum Vaillant, l. c. 61: Alrordius pellatus Jordan, l. c. 220.)

aa. Vertebræ less than 40; dorsal spines 10 or 11; palatine teeth obsolete; males with the lower fins tuberculate in spring. (Ericosma\* Jordan.)

## 787. A. evides Jordan & Copeland.

Body moderate, somewhat compressed. Head heavy, the profile rather convex. Eye rather large, high, 3½ in head. Mouth moderate, somewhat oblique, the lower jaw included; maxillary reaching front of eye. Cheeks, neck above, and throat naked; Opercles with rather large scales; ventral plates little enlarged. Fins large; second dorsal lower

<sup>\*</sup>Ericosma Jordan, Bull. U. S. Nat. Mus. x, 8, 1877: type Alrordius erides Jordan & Copeland;  $(\dot{\eta}\rho, \text{spring-time}; \pi o \sin \omega)$  to adorn.)

than anal, but with longer base. Coloration extremely brilliant: dark olivaceous above, tessellated with dark; sides with about 7 broad transverse bars extending from below the lateral line on one side across the back and down the other side; these bars are wider than the eve and are connected along the lateral line by a faint black stripe. In the female these bars are black and the intervening spaces vellowish. In the male the bars are of a dark rich blue-green with metallic lustre; the connecting longitudinal line greenish-bronze; just above this line is a luminous yellowish streak, and above in each of the interspaces between the bars is a bright blotch of bronze-red; entire lower parts of the body of a bright clear yellow, which becomes on the under side of the head, throat, and branchiostegals a bright orange-red; blackish green streaks downward and forward from eye; cheeks orange-red, the color of iron rust: dersal fin orange-colored, with a bright bronze edge, a blackish spot on the last rays; second dorsal and caudal pale orange; two bright vellowish spots at base of caudal; anal bronze, with a blue-black shading; ventral fins dark blue-black; pectorals faintly orange. Males with the rays of the ventral and anal fins covered with small corneous tubercles, exactly as in some Cyprinide. Female and alcoholic specimens show little of the bright colors, although the same pattern is preserved. The spinous dorsal has a dusky spot on its posterior rays, and the fins are destitute of the dark bars found in the other species of Alvordius. Head  $4\frac{1}{3}$ ; depth  $5\frac{1}{3}$ . D. XI-10; A. II, 8; scales 9-63-9. L. 2-3 inches. White River, Indiana; locally abundant; one of the most brilliant of fishes.

(Alvordius evides Jordan & Copeland, Proc. Acad. Nat. Sci. Phila. 1877, 51: Ericosma evides Jordan, Bull. U. S. Nat. Mus. x, 8, 1877.)

## 788. A. fasciatus (Grd.) Jor.

"It has the same blennioid aspect as its congener (Alvordius aspro); the total length of the specimens observed measuring about two inches and a quarter, the head entering in it four times and a half. The eye is of medium size, subcircular; the diameter being contained 4 times in the side of the head. The first dorsal is lower and longer than the second, to which it is contiguous. The anal is well developed, rather deeper than the second dorsal but shorter upon its base. The caudal fin is subtruncated. The ventrals and the pectorals are of moderate development, their tips being nearly even. The rays are D. X, 12; A. I, 8; the scales are small, deeper than long, posteriorly rounded off and minutely pectinated, whilst their anterior margin is truncated, exhibiting numerous radiating ridges upon the latter section only. Their im-

brication takes place after the fashion of the Sciænoids; instead of longitudinal series, they constitute transverse oblique series. As to the coloration, it is but imperfectly preserved. Transverse bands of deep chestnut alternate with white or yellowish ones. These bands or fasciæ are better defined below the lateral line than above it, where they are sometimes interrupted. The head is brown, with a vertical black streak across the orbits. The fins are yellowish, unicolor, except the first dorsal, which is margined with black. During life we imagine this fish to be one of the prettiest inhabitants of the fresh waters of this continent." (Girard.) Chihuahua River, Mexico. The types of this species are lost, but it is doubtless closely allied to A. erides.

(Diplesion fasciatus Girard, Proc. Acad. Nat. Sci. Phila. 1859, 161.)

### 262.—HADROPTERUS Agassiz.

(Hypohomus Cope: Plesioperca Vaillant.)

(Agassiz, Amer. Journ. Sci. Arts, 1854, 305: type Hadropterus nigrofasciatus Ag.)

This genus differs from *Alvordius* only in the absence of the cadueous ventral plates, the belly being covered with persistent scales, similar to those on the sides. ( $\hat{a}\delta\rho\hat{o}\varsigma$ , strong;  $\pi\tau\varepsilon\rho\hat{o}\nu$ , fin.)

- a. Anal fin large, not smaller than the second dorsal.
  - b. Scales small, more than 75 in the lateral line; body elongate, little compressed;
     D. XV-15. (Hypohomus\* Cope.)

## 789. II. aurantiacus (Cope) Jor.

Form elongate; candal peduncle slightly contracted; orbit smaller than length of muzzle, 4 in head, excluding the opercular spine; mandibles shorter than muzzle; cheeks and operculum covered with small scales; scales very small, covering the ventral line; gular region smooth; third dorsal ray longest, fin outline rapidly descending posteriorly; first anal ray below first of second dorsal; caudal fin even. Golden-brown above, with a series of small round brown spots nearer to the basis of the dorsal fin than the lateral line; the latter traversed by a broad black band, which passes on sides of head around muzzle; below bright citron-yellow; fins unspotted. Head 4½ depth 6. D. XV-15; A. II, 11; Lat. l. about 85. L. 4½ inches. (Cope.) Headwaters of Tennessee River.

(Cottogaster aurantiacus Cope, Journ. Acad. Nat. Sci. Phila. 1869, 211: Hypohomus aurantiacus Cope, Proc. Amer. Philos. Soc. 1870, 451: Hadropterus aurantiacus Jordan, Man. Vert. 221.)

bb. Scales large, less than 60 in the lateral line; body robust, more or less compressed; dorsal XII-12. (Hadropternst.)

<sup>\*</sup> Hypohomus Cope, Proc. Amer. Philos. Soc. 1870, 451: type Cottogaster aurantiacus Cope.  $(\tilde{v}\pi\omega$ , below;  $\dot{o}\mu$ os, uniform.)

<sup>†</sup> Plesioperca, Vaillant.

### 799. H. migrofasciatus Agassiz.—Crawl-a-bottom.

Head and body stout and heavy, the body compressed. Mouth moderate, the maxillary reaching front of eye; eye moderate, 4 in head. Scales rather large. Fins all large. Breast usually naked, but sometimes closely scaled; scales on the median line of the belly somewhat enlarged, but not caducous nor especially spinous. Dark olive above, with blackish markings; sides with vertical bars, somewhat diamond-shaped, but quite narrow; these acute above and below, more or less confluent along the middle, about 12 in number; the bands dark greenish, varying to jet black, most distinct near the middle of the body and broadest behind; inner half of each of the vertical fins black; outer half more or less speckled and barred; top of head black, a black band through eye and shout, and a dark vertical shade below the eye; a small black spot between two smaller ones at base of caudal fin. Head 4; depth 5. D. XII-12; A. II, 10; scales 7-58-15. L. 4 inches. Rivers of the Southern States from South Carolina to Louisiana; one of the largest of the darters.

(Agassiz, Amer. Jonrn. Sci. Arts, xvii, 305, 1854; Jordan, Ann. Lyc. Nat. Hist. N. Y., 1877, 310; Plesioperca anceps Vaillant, l. c., 37; Alvordius spillmani Hay, Proc. U. S. Nat. Mus. 1880, 491, from Chickasawha River, Mississippi, specimens with the eye larger, the snout more pointed, the fins higher, and the color very dark.)

### 263.-NOTHONOTUS Agassiz.

## Blue-breasted Darters.

(Agassiz, Bull. Mus. Comp. Zoöl. 1863, i, 3: type Etheostoma maculatum Kirtland.)

Body robust, or rather elongate, compressed. Mouth terminal, moderate; the lower jaw somewhat included; premaxillaries not protractile; maxillary movable. Teeth strong, present on vomer and palatines. Gill-membranes scarcely connected. Scales moderate or small, etenoid; those of the middle line of the belly not enlarged, persistent. Lateral line well developed, nearly straight. Fins large, with strong spines; first dorsal longer and larger than the second with 10 to 15 spines; anal with two strong spines, the anterior usually the larger. Coloration often brilliant. ( $\nu a \theta a z$ , prominent;  $\nu a z a z$ , back, in allusion to the large size of the dorsal fins, the name given in opposition to Catonotus.)

 a. Head short, the muzzle abruptly decurved; lat. 1, 52; dorsal spines 10 to 12; fins dark-edged.

# 791. N. camurus (Cope) Jor.—Blue-breasted Darter.

Body stout; head short; muzzle abruptly decurved, the mouth somewhat inferior; lower jaw included. Caudal broad, truncate. Males very

dark olive or blackish, with an obscure band of a paler shade; belly paler; breast and throat deep rich blue; sides profusely sprinkled with crimson dots; these spots sometimes arranged in short longitudinal series of threes and fours; series of olivaceous lines along the rows of scales; first dorsal with a black spot at base in front and a crimson one on the margin between the first and second rays; second dorsal, caudal, and anal crimson, bordered with yellow, which again is bordered with black or dark blue on the edge of the fin; the crimson is deepest next the yellow; pectoral and ventral fins with a broad red margin. Females less distinctly marked; olivaceons, somewhat barred. Head 4; depth 4½. D. XI-13; A. II, 8; scales 7-53-8. L. 2½ inches. Ohio to Tennessee in clear streams; one of the most elegant members of this most beautiful genus.

(Paciliehthys camurus Cope, Proc. Am. Philos. Soc. Phila. 1870, 265: Nothonotus camurus Jordan, l. c. 225.)

- aa. Head rather long and pointed; muzzle not decurved.
  - b. Dorsal spines 10 to 12.
    - c. Scales small; lateral line 55 to 65; fins not dark-edged.
      - d. Body slender.

### 792. N. sanguifluus (Cope) Jor.

Body elongate, with dorsal line not elevated, and the caudal peduncle very deep. Head flat, acuminate, the front descending very gradually, the mandible rising as gradually to its extremity; orbitrather large, equal to snout, 4 in head; end of maxillary reaching front of pupil; teeth of outer row larger. Fins generally, especially the caudal, short; latter slightly rounded; first dorsal much elongate; first anal spine very large. Coloration above black, shading to dark olive below, and with a narrow, wavy, leather colored dorsal band; throat turquoise blue; sides and dorsal region marked with small circular spots of bright crimson, irregularly disposed, and in considerable number; first dorsal uncolored, with a black spot at base anteriorly and a dark shade through the middle; second dorsal blood-red, without border; candal with two large crimson spots confluent on the middle line of the tail at its base, without border; pectorals and ventrals not red-bordered; females dull, with the fins black-barred and not crimson. Head 4; depth 54. D. XII-12; A. II, 9; scales 9-58-10. L. 23 inches. South Fork of Cumberland River, Tenn. (Cope.)

(Paciliehthys sauguiftuus Cope, Proc. Am. Philos. Soc. Phila. 1870, 264: Nothonotus sanguiftuus Jordan, Man. Vert. 226.)

dd. Body comparatively deep, compressed.

## 793. N. maculatus (Kirtland) Ag.

Body moderately elongate, deep, and compressed. Head long and rather pointed. Mouth rather large; jaws equal. Dorsal fin elevated, the longest rays reaching caudal. Olive green; sides with rather large spots of brilliant carmine; vertical fins more or less barred with red and white. Head 4; depth  $4\frac{2}{3}$ . D. XII-13; A. II, 8; Lat. l. 60. L.  $2\frac{1}{3}$  inches. Mahoning River, Ohio; not yet recognized elsewhere.

(Etheostoma maculata Kirtland, Bost. Journ. Nat. Hist. 1840, 276: E. maculata Storer, Synopsis, 270: Nothonotus maculatus Agassiz, Bull. M. C. Z. 1863, 3: Nothonotus maculatus Jordan, Man. Vert. 225.)

cc. Scales larger: lateral line 43 to 47; body stout.

## 794. N. rufilimeatus (Cope) Jor.

Stout, the dorsal line elevated and descending regularly from the base of the first dorsal to the end of the muzzle. Muzzle short, regularly conic, about equal to eye, which is smaller than usual, 41 in head. Dorsal well developed; caudal peduncle deep; caudal fin small, trun-Seales large. Color pale olive, with numerous narrow longitudinal lines, each on the adjacent margins of two rows of scales; these lines include a number of quadrate spots of a mahogany or brick-red color, which alternate with each other, but are not regular in position or number; pectoral region bright turquoise blue; belly bright reddish orange; head with two longitudinal mahogany-colored bands, and a spot of the same below the eye; five red spots on each side of the head, one on operculum, preoperculum, suboperculum, and on each lip; fins all broadly erimson-bordered, the anal and caudal with narrow black edging; two orange areas at base of caudal; anal vermilion, with yellow base and black margin on posterior half. Females more olivaceous, obscurely barred and with the fins speckled. Head 4; depth 4½. D. XI-12; A. II, 8; scales 6-45-7. L. 3 inches. French Broad River, Warm Springs, N. C. (Cope.)

(Pacilichthys rufilineatus Cope, Proc. Am. Philos. Soc. Phila. 1870, 267.)

bb. Dorsal spines 14; scales small; lat. l. 53; back not arched.

### 795. N. vulmeratus (Cope) Jor.

Body fusiform, stout. Caudal peduncle very deep. Dorsal outline scarcely arched; top of head gently and regularly curved to the end of the muzzle, much as in *N. sanguiftuus*. Orbit four times in length of head, equal to muzzle. First dorsal not low; caudal truncate, rounded; anal small; scales small. Color light olive, with about eight vertical

dkar olive bars on the sides, which are interrupted above the lateral line; a few irregular crimson dots on the sides. Fins uniform, transparent, except the first dorsal and caudal; the former has a median series of red spots, the latter is pale orange, with a black margin; no cross-bars on fins in the male; second dorsal with a black margin. Head 4; depth 4½. D. XIV-13; A. II, 8; scales 8-53-9. L. 2 inches. French Broad River. (Cope.)

(Pwcilichthys vulneratus Cope, Proc. Am. Philos. Soc. Phila, 1870, 266.)

\*\* Species incompletely described.

The following species have not been recognized since their original description. They perhaps belong to *Nothonotus*.

## 796. N.? tessellatus (Storer).

"Body oblong. Head gibbous, less than one-fourth the length of the body. Lateral line straight. Top of the head and upper portion of the sides of a greenish-brown color; 8 or 10 transverse bluish bands on the sides; the intervals between these bands are yellowish, and in the centre of each is a bluish rhomb; a black blotch at the base of the tail; the lips, opercles, and rays of the first dorsal gamboge-yellow. D. XII-13; P. 13; V. I, 5; A. II, 10. L. 3 inches. Florence, Ala. Caught in running water." (Storer.)

(Etheostoma tessellata Storer, Proc. Bost. Soc. Nat. Hist. 1845: E. tessellata Storer, Synopsis, 273.)

### 797. N.? cinereus (Storer).

"Body oblong, compressed. Head gibbons directly over the eyes. The upper portion of the sides is of a light yellow color, crossed longitudinally by 3 or 4 cinercous interrupted narrow bands, one or two of which commence at the snout, the others back of the head, and are lost anterior to the tail; between these bands is a series of longitudinally-arranged oval blotches, of a similar color, and from these bands descend obliquely backward and downward to the abdomen narrow transverse lines; lower portion of the sides yellowish-white; first dorsal margined with red; second dorsal and anal variegated with red dots. D. XI-13; P. 15; V. I, 5; A. II, 8. L. 3-4 inches. Florence, Ala. Caught in deep, still water when fishing for perch." (Storer.)

(Etheostoma einerea Storer, Proc. Bost. Soc. Nat. Hist. 1845: E. einerea Storer, Synopsis 273.)

264.—NANOSTOMA Putnam.

(Putnam MSS. Jordan, Bull. U. S. Nat. Mus. x, 7, 1877: type Pacifichthys zonalis Cope.)

Body fusiform, not greatly compressed. Mouth small, subinferior,

the premaxillaries not protractile. Vomerine teeth very feeble or wanting. Scales large. Gill-membranes broadly connected; no enlarged ventral plates. Lateral line complete. Dorsals well separated, the second larger than anal, higher and shorter than spinous dorsal; dorsal spines about 10; anal spines 2. (νανος, small; στόμα, mouth.)

a. Cheeks, opercles, and throat closely scaled.

## 798. N. zonale (Cope) Jor.

Body slender, somewhat compressed. Head small, rather short; the month small, subinferior. Snout decurved, rather obtuse, maxillary not reaching front of eye. Cheeks, opercles, neck, and throat closely scaled. Eye rather large. Teeth very feeble, those on the vomer not evident; probably none on the palatines. First dorsal well developed. separated from the second, which is higher and shorter than the spinous dorsal, and considerably larger than the anal; caudal emarginate. Bright olivaceous above, golden below; 6 dark-brown quadrate dorsal spots, which connect by alternating spots with a broad brown lateral band, from which 8 narrower dark-bluish bands more or less completely encircle the belly; paired, anal, and caudal fins golden, brown-spotted; middle half of the first dorsal crimson; a series of round crimson spots near the base of the second dorsal; occiput, a band on muzzle and one below eye black; a black spot on operculum and one at base of pectoral; females duller and speckled with ventrals barred and lateral bars feebler. Head 4\(\frac{1}{4}\); depth 5. D. XI-12; A. II, 7; scales 11-50-12. L. 3 inches. Mississippi Valley, in clear streams: rather rare.

(Pacilichthys zonalis Cope, Journ. Acad. Nat. Sci. Phila. 1868, 212; Jordan, Man. Vert. 225: Nanostoma vinctipes Jordan, Bull. U. S. Nat. Mus. ii, 236, 1879; the female.)

## 799. N. elegans Hay.

Body stout, somewhat compressed. Head short and deep, with swollen cheeks. Snout abruptly decurved. Mouth subterminal, horizontal, small, the maxillary not reaching the front of the eye. Eye 4 in head. Lateral line nearly straight. Cheeks, opercles, and back of neck scaly; chest and region just behind ventrals naked. Spinous dorsal half as high as long, a little longer than the head; soft dorsal  $\frac{5}{6}$  as long as head and  $\frac{9}{3}$  as high as long; anal  $\frac{3}{4}$  length of head, as high as long; pectoral fins very large, reaching beyond ventrals to vent. Color purplish; 6 large quadrate black blotches along back and 8 broad transverse bars along sides fainter, these alternating with dark spots; many of the scales above with jet-black spots forming longitudinal streaks; two black spots at base of caudal; a few black spots behind

eye; dark spots downward and forward from eye; ventral and anal fins indigo-blue; pectorals with blue; a bar of deep orange-red along base of both dorsals. Head 4; depth 5. D. X-12; A. H. 8; scales 5-42-6. L. 24 inches. Chickasawha River, Mississippi. (*Hay*.)

(Hay, Proc. U. S. Nat. Mus. 1880, 493,)

aa. Cheeks, opercles, and breast entirely scaleless.

## 800. N. thalassimum Jordan & Brayton.

Body rather stout, compressed behind, the back somewhat arched. Head large, the snout rather blunt and convex in profile. Eye large, high up, longer than muzzle, 33 in head; interorbital space rather narrow. Mouth moderate, slightly oblique, the maxillary reaching to the orbit. Upper jaw slightly longer than the lower. Head entirely naked: throat naked; neck naked anteriorly. Fins all large; membrane of the first dorsal continued to the base of the second; longest dorsal spine scarcely shorter than the soft rays, the base of the spinous dorsal a little longer than that of the soft dorsal; anal not much smaller than the soft dorsal, its first spine the longer; candal fin deeply lunate; pectorals reaching nearly to vent. Male, in life, with the body dark green and blotched above; sides with 9 dark blue-green vertical bars, the five next the last most distinct; spinons dorsal reddish at base, then a broad black band, the uppermost third of a bright ferruginous red; second dorsal blackish at base, reddish above; caudal with 2 orange blotches at base, black mesially, pale orange distally; anal fin of a brilliant blue-green color at base, pale at tip; ventrals greenish; head mostly grass-green; the streaks forward and downward from eye dark green; females duller and more speekled. Head 4; depth 5. D. X-11; A. II, 8; scales 5-43-5. L. 2½ inches. Saluda River, South Carolina; abundant.

(Nothonotus thalassinus Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 13, 1878.)

#### 801. N. tessellatum Jordan.

Color olivaceous, the markings obliterated in the type. Body fusiform. Head broad and heavy, entirely naked. Mouth moderate, horizontal, the lower jaw included, the maxillary extending to opposite front of eye. Anal higher than second dorsal, but not so long, its spines strong. Gill-membranes broadly united. D. X-12; A. H, 8; Lat. l. 48. L. 2½ inches. Allegheny River; only the type (1199, U. S. Nat. Mus.) now known.

(Hadropterus tessellatus Jordan, Bull. U. S. Nat. Mus. x, 7, 1877.)

802. N. imseriptum Jordan & Brayton.

Body rather stout and deep, strongly compressed. Caudal peduncle Head large, rather obtuse, the profile quite gibbous, a considerable angle formed opposite the eyes, which are high up and close Eye about equal to snout, 31 in head. Mouth moderate. slightly oblique, the maxillary reaching eye, the upper jaw the longer. Head entirely scaleless; neck above scaly; breast naked; belly closely scaled: scales large. Fins large; spinous dorsal longer than soft dorsal, which is somewhat larger than the anal: the two dorsals connected by membrane: dorsal spines a little more than half the length of the head: pectorals large. Color olive, with a bright scarlet spot on each scale, these forming continuous lines along the rows of scales; 3 dark blotches across the back; one in front of dorsal, forming a black spot on the anterior spines; one between the two dorsal fins, forming a similar black spot on the last rays of the spinous dorsal; and one on the caudal peduncle, behind the second dorsal; sides with about 6 irregular dark-olive blotches just below the lateral line; edge of spinous dorsal black, below this bright orange-red, a dusky bar at the base; entire anal fin, cheeks, opercles, and a bar below the eye bright blue; females without red spots, the sides Head  $4\frac{3}{4}$ ; depth  $4\frac{3}{4}$ . D. XI-12; A. II, 8; scales 5-46-5. L. 23 inches. Oconee River, Georgia; one of the most beautiful of the group.

(Nothonotus inscriptus Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 34, 1878.)

## 265.—ETHEOSTOMA Rafinesque.

(Catonotus Agassiz.)

(Rafinesque, Journ. de Physique, 1819, 419: type Etheostoma flabellaris Raf.)

Body elongate, compressed. Mouth terminal, more or less oblique; upper jaw not protractile. Vomerine teeth present; teeth in the jaws strong, the outer series canine-like. Opercular spine well developed. Gill-membranes broadly united. Scales rather large. Lateral line incomplete; an enlarged, black humeral scale. First dorsal fin low, considerably lower than the second dorsal, of 7 to 9 subequal spines, which, in the males, end in little fleshy knobs; anal fin smaller than the second dorsal, with 2 spines, the first of which is always the larger. Vertebrae ( $E.\ lineolatum$ ) 14+21; size small. Coloration dark. The species are extremely quick in their movements, and their coloration, although not gaudy, is very elegant.

(The word Etheostoma is stated by Rafinesque to mean "various mouths," the species known to him—i. e., Pereina caprodes, Diplesium blennioides, and Etheostoma flabellare—

being so different in respect to the form of the mouth, that he conceived that they might belong to different subgenera. The etymology of the word is not evident.)

- a. Head entirely naked; lateral line short; lower jaw prominent.
  - b. Body with longitudinal dark stripes.

## 833. E. lineolatum (Ag.) Jor.—Striped Darter.

Body elongate, compressed, the back scarcely arched. Head long and rather pointed, entirely destitute of scales. Mouth rather large, terminal, oblique, the lower jaw the longer. Eye moderate, longer than the snout, about 4 in head. Opercular spine strong. Fins all low, the first dorsal in the males about half as high as the second; higher in the females; caudal large, rounded. Anal spines longer in females than in the males: dorsal and anal spines pointed in the female, in the male with thickened fleshy tips. Scales moderate. Lateral line extending about to end of first dorsal. Neck and throat naked; scales on sides extending up to the base of the dorsal fin. Color dark; each scale with a dark spot, these forming a series of conspicuous longitudinal lines along the rows of scales; second dorsal and caudal conspicuously cross-barred; head blackish, with dark stripes radiating from eye; males further marked with conspicuous dark cross bars. Head 4: depth 5. D. VIII-12; A. II, 8; scales 7-53-7. L. 23 inches. Minnesota to Indiana; abounding in clear or rocky streams; one of the most singular and handsome of the darters.

(Catonotus lincolatus Agassiz, Amer. Journ. Sci. Arts. 1854, 305: Catonotus lincolatus Vaillant, l. c. 118.)

bb. Body not striped.

### 804. E. flabellare Raf.

Very similar to the preceding, but rather more clongate and less compressed. Head rather larger. A narrow strip along base of spinous dorsal not scaled. Coloration paler, there being little or no trace of the longitudinal stripes, so conspicuous in *E. lincolatum*; the males with cross blotches, the females nearly plain olivaceous; second dorsal and caudal fins barred; black humeral spot conspicuous. Lateral line usually very little developed; lower jaw less projecting than in *E. lincolatum*. Head 4; depth 5. D. VIII-12; A. II, 8; Lat. l. 46. Length  $2\frac{1}{2}$  inches. Western New York to Ohio Valley and North Carolina; very abundant in the tributaries of Lake Ontario.

(Rafinesque, Journ. de Phys. etc. Paris, 1819, 419; Catonotus flabellatus Vaillant, Recherches, 1873, 121; Catonotus fasciatus Girard, Proc. Acad. Nat. Sci. Phila. 1859, 67; Oligocephalus humeratis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 66; ?Catonotus

Bull. Nat. Mus. No. 16-33

kennicotti\* Putnam, Bull. Mus. Comp. Zool. 1863, 3: Etheostoma linsleyi Storer, Proc. Soc. Nat. Hist. 1851, 37: Catonotus flabellatus Vaillant l. e. 121: Catonotus linsleyi Vaillant, Recherches, 1873, 125: Etheostoma flabellare Jordan, Man. Vert. ed. 2, 227.)
aa Checks, opercles, neek, and throat closely scaly; jaws equal; lateral line nearly complete.

#### 805. E. scummicens Jordan.

Body rather elongate, considerably compressed, the caudal peduncle deep. Head large; the jaws comparatively short and equal. Lateral line wanting only on a few of the posterior scales, and with occasional tubes behind the continuous series. Spinous dorsal low and short, the spines about equal, less than half the height of the second dorsal; bases of the two dorsals about equal, slightly connected by membrane. Color dark, without spots, stripes or bands, in spirits; male mottled, with about 6 cross-blotches; vertical fins cross-barred; lower fins black in the male, pale in the female; a large black humeral spot. Head  $3\frac{1}{5}$ ; depth 5. D. IX-12; A. II, 7; scales 5-50-6. L.  $2\frac{3}{4}$  inches. Ohio Valley; not common.

(Jordan, Bull. U. S. Nat. Mus. x, 11, 1877.)

## 266.-PŒCILICHTHYS Agassiz.

### Rainbow Darters.

(Oligocephalus, Boleichthys, Aplesion, and Alvarius Girard: Astatichthys Vaillant: Hololepis Agassiz.)

(Agassiz, Amer. Journ. Sci. Arts, 1854, 304: type Pacilichthys variatus Agassiz=Ethcostoma carulea Storer.)

Body variously robust or elongate, usually compressed. Head rather large. Month moderate, nearly horizontal, terminal or nearly so; vomer with teeth; premaxillaries not protractile. Gill-membranes scarcely connected. Scales rather large, those on the belly similar to the others. Lateral line wanting posteriorly, its tubes beginning at the orbit. Dorsal spines 6 to 11, the middle ones highest and more than half the height of the soft rays; second dorsal larger than spinous dorsal or anal; anal with two spines, the first usually the larger. Vertebræ in P. cæruleus, 15 + 18; in P. cos, 15 + 21. Size small. Coloration usually brilliant. ( $\pi o \iota z \iota \lambda o z$ , variegated;  $7 \iota z \theta \delta z$ , fish.)

<sup>\*</sup>The original types of Catonotus kennicotti, now in poor condition, show the following characters:

Color plain, without trace of lines or spots; pectorals, caudal, and both dorsals checkered with black. Black humeral spot large. Checks, opercles and breast naked. Scales rather large. Lateral line extending to below middle of second dorsal. Gill-membranes forming an angle with each other. Pectorals a little shorter than head. Head 3\(\frac{3}{4}\); depth 5\(\frac{1}{2}\). D. VIII, 10; A. 11, 5; scales 5-40 6. From Southern Illinois.

- a. Dorsal spines 8 or more; anal spines well developed. b. Humeral region with an enlarged black scale-like process. c. Cheeks and opercles naked; nape naked; body striped, ............rirgatus, cc. Cheeks and nape naked; opercles scaly ...... saxutilis, cce. Cheeks, opereles, and nape more or less scaly ......punctulatus, artesia. bb. Humeral scale obsolete or wanting. d. Opercles and cheeks naked; preopercle erenulate; anal spines very long. levidas. dd. Opercles scaly; preopercle strictly entire. ε. Lateral line nearly straight. f. Cheeks naked; or with only 3 or 4 small imbedded scales close behind ff. Cheeks evidently scaly, at least above ......asprigenis, jessia.
  - Dorsal spines 9 or 10. (Boleichthus Girard.) g. Cheeks scaly ..... butlerianus, barratti, fusiformis, erochrous, cos. gg. Cheeks naked ......exilis, warreni, gracilis,

ce. Lateral line forming a slight curve above the pectorals; dorsals sub-conal.

- a. Dorsal spines 8 or more; anal spines well developed.
  - b. Humeral region with an enlarged scale-like process, which is always black.
    - c. Opercles, cheeks, and nape naked; body striped.

### 806. P. virgatus Jordan.

Body slender, subfusitorm, compressed, the back somewhat elevated. the caudal peduncle rather deep. Head long, rather slender and pointed. little compressed, the snout but little decurved. Mouth rather large, somewhat oblique, the maxillary reaching to the pupil, the lower jaw scarcely shorter than the upper; teeth small, even, in several rows. Eye rather large. Posterior border of preopercle above, obtusely crenate. Scales rather large; lateral line distinct, on about 20 scales; 53 in a lengthwise series. Head naked; nape and breast naked. Color greenish, each scale with a small blackish spot, forming conspicuous lateral stripes, as in *Etheostoma lineolatum*; back and sides with cross-blotches; humeral scale large and black; dorsal and caudal fin faintly barred. Head 3\frac{3}{3}; depth 5. D. IX-10; A. H. 8. Rock Castle River, Kentucky; resembles the species of Etheostoma.

(Jordan, Proc. U. S. Nat. Mns. ii, 236, 1879.)

cc. Cheeks and nape naked; opercles scaly.

## 807. P. saxatilis Hay.

Body rather slender. Head pointed, the profile descending in a gradual curve. Mouth large, the maxillary extending to opposite front of pupil. Eye equal to snout, 4 in head. Cheeks, breast, and throat naked; opercles with a few large scales. Lateral line little arched, its tubes on about 35 scales. Dorsals well separated, the second shorter and higher than first. Greenish, with darker tessellations; a black

humeral scale, a black streak downward and forward from eye; opereles mostly black. Head 4; depth 5. D. XI-10; A. II, 7; scales 11-50-5. L. 1½ inches. Chickasawha River, Mississippi. (*Hay.*) (Hay. Proc. U. S. Nat. Mus. 1880, 495.)

ccc. Cheeks, opercles, and nape more or less scaly,

### 808. P. punctulatus Ag.

Body elongate, compressed, the back not elevated. Head slender, rather long and pointed, compressed. Mouth large, terminal, oblique, the jaws about equal, the maxillary extending nearly to opposite middle of eye. Scales quite small; a few imbedded scales on upper part of cheeks and behind eye; neck mostly covered with small scales; throat naked. Fins rather small, the pectorals short. Color, in life, not known; in spirits, the sides of the body clouded or reticulated with darker; a conspicuous black humeral spot; first dorsal dark at base, then pale, with a narrow dark border; the other vertical fins similarly colored, the dark colors probably blue in life; females with the sides and firs speckled. Head 4; depth 4½. D. X-11; A. II, 7; scales 9-60-20. L.  $2\frac{1}{2}$  inches. Missouri to Texas.

(Agassiz, Amer. Jonrn. Sci. Arts, 1854, 304: Boleichthys whipplei Girard, Proc. Acad. Nat. Sci. Phila. 1859, 101: Nothonotus punctulatus Agassiz, Bull. Mus. Comp. Zoöl. i, 3, 1863.)

### 809. P. artesiæ Hay.

Body elongate, compressed. Head large. Mouth large, terminal, nearly horizontal, the lower jaw slightly included; maxillary reaching to opposite front of pupil. Palatine teeth in a broad band. Eye equal to snout, 43 in head. Cheeks entirely covered with small scales; opercles with large scales; scales along back very small. Lateral line extending to end of second dorsal, on about 45 scales. Dorsals contiguous; first dorsal as long as head, its height less than half its length; soft dorsal considerably higher; anal a little over half length of head; pectorals reaching tips of ventrals, much smaller than in P. caruleus. Yellowish-olive, with transverse oblique bars of darker, and sprinkled with small blotches of carmine; pectorals and ventrals dull blue; dorsals with a broad band of carmine along their middle, bordered on each side by orange; tips of dorsals dull blue, as is the base of the soft dorsal; base of spinous dorsal with several carmine spots; anal mostly crimson, tipped with blue; caudal blue, then orange, carmine orange, and tipped with blue; a black humeral scale. Head  $3\frac{3}{4}$ ; depth 5. D.

XI-13; A. II, 7; scales 8-56-11. L.  $2\frac{3}{4}$  inches. Tombigbee River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1880, 494.)

bb. Humeral scale obsolete.

d. Opercles and cheeks naked; preopercle crenulate; anal spines very long.

## 810. \* P. lepidus (B. & G.) Grd.

Body rather stont, compressed, tapering backwards. Head subconical. Mouth moderate, with equal jaws; maxillary reaching front of orbit. Eyes large. First dorsal rather low; dorsal fins somewhat connected. Head, as well as throat and neck, entirely scaleless. Color olivaceous, with some dark (blue?) bars; scales dusky at base; dorsals and caudal mottled or barred. Head  $4\frac{1}{4}$ ; depth  $4\frac{2}{3}$ . D. IX-11; A. II, 6; scales in about 50 series. L. 23 inches. Texas.

(Bolcosoma lepida B. & G. Proc. Acad. Nat. Sci. Phila, 388, 1853; Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 11: Oligocephalus lepidus Grd. Proc. Acad. Nat. Sci. Phila, 1859, 67: Bolcosoma lepidum Günther, i, 77.)

dd. Opercles scaly; preopercle strictly entire; anal spines moderate.

e. Lateral line nearly straight.

f. Cheeks naked, or with only 3 or 4 small imbedded scales close behind eye.

## 811. P. corniens (Storer) Agassiz.—Blue Darter; Rainbow Darter; Soldier-fish.

Body robust, rather deep and compressed, the back somewhat elevated. Head large, compressed. Mouth moderate, terminal, oblique, the lower jaw somewhat included, the maxillary reaching front of orbit. Palatine teeth in one row. Neck and breast usually naked. Fins all large; dorsal fins usually slightly connected. Males olivaceous, tessellated above, the spots running together into blotches; back without black lengthwise stripes; sides with about 12 indigo-blue bars running obliquely downwards and backwards, most distinct behind, separated by bright orange interspaces; caudal fin deep orange, edged with bright blue; anal fin orange, with deep blue in front and behind; soft dorsal chiefly orange, blue at base and tip; spinous dorsal crimson at base, then orange, with blue edgings; ventrals deep indigo; cheeks blue; throat and breast orange; females much duller, with little blue or red, the vertical fins barred or checked; young variously marked, 3<sup>3</sup>; depth 4<sup>1</sup>. D. X-12; A. II, 7; scales 5-45-8, the lateral line developed on about 30-35 scales. L. 23 inches. Mississippi Valley; very

<sup>\*</sup>Four more nominal species of this type are described by Girard (Proc. Acad. Nat. Sci. Phila. 1859, 102) under the names Aplesion potsii, Oligocephalus grahami, O. Iconensis, and O. pulchellus; the first from Chilmahna, the next two from Texas, the latter from Canadian River. A. potsii has D. X-1, 11; O. grahami has D. IX-13; A. II, S; O. Iconensis D. IX-10; A. II, 7; O. pulchellus A. II, 6. All are probably identical with P. lepidus.

abundant in river channels. One of the most gorgeously-colored darters, but less graceful than most of them.

(Etheostoma carulca Storer, Proc. Bost. Soc. Nat. Hist. 1845, 47: Pacilichthys carulcus Agassiz, Bull. Mus. Comp. Zoöl. i, 3, 1863: Pacilichthys variatus Jordan, Man. Vert. ed. 2, 226: Astatichthys pulchellus Vaillant, 1. c. 113.)

### 812. P. spectabilis Agassiz.

Very similar to the preceding, but more elongate and rather more compressed; the colors similar, but the upper portion of the sides with distinct blackish stripes along the rows of the scales, and the ground color of the back and sides having a peculiar whitish or bleached appearance. The two dorsal fins usually well separated. Scales usually present below and behind eye. Head 4; depth 4½. D. X-12; A. II, 7; scales 5-40-7; Lat. l. on 20-25 scales. L. 2-3 inches. Mississippi Valley; rather less abundant than the other, and ascending small or even muddy streams. Probably merely a brook variety of the preceding, from which it is not always to be distinguished with certainty.

(Agassiz, Amer. Journ. Sci. Arts, 1854, 304; Jordan, Man. Vert. ed. 2, 227.)

ce. Checks evidently scaly, at least above.

## 813. P. asprigenis Forbes.

Body rather stout, compressed. Head small and pointed. Eye large, longer than snout. Mouth terminal, oblique, the jaws even. Breast always naked; opercles scaly; checks closely scaled, the lower fourth rarely bare. Dorsal fins usually separated. Coloration mottled greenish; the spinous dorsal dusky behind, in life with a broad band of blue and crimson; soft fins speckled. Head 4; depth  $4\frac{1}{2}$ . D. XI-12; A. II, 8; Lat. l. 49, the tubes developed on 34–41 scales. L.  $2\frac{1}{2}$  inches. Illinois River.

(Forbes, Bull. Ill. Lab. Nat. Hist. i, 41, 1877; Jordan, Man. Vert. ed. 2, 404.)

## 814. P. jessiæ Jordan & Brayton.

Body fusiform, rather deep and compressed. Head rather large, moderately pointed. Mouth rather large, terminal, the upper jaw slightly longest. Cheeks scaly above, the greater part naked; opercles scaly; throat naked; neck above scaly. Lateral line extending nearly to end of second dorsal. Fins moderate. Chestnut colored above, with about 9 quadrate bar-like blotches of a dark-blue color along the sides, and about 5 dark cross-blotches on the back; fins mottled with chestnut; a yellow or orange band across the dorsal; second dorsal and anal speckled with golden. Head 4; depth 5. D. XII-12; A. II, 9; scales

6-47-7, the tubes of the lateral line on about 35 scales. L. 3 inches. Chickamauga River, Georgia.

(Jordan, Man. Vert. ed. 2, 1878, 227; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 59, 1878.)

ee. Lateral line forming a slight curve above the pectorals; dorsals subequal; dorsal spines 9 or 10. (Boleichthys\* Grd.)
g. Cheeks scaly.

## 815. P. butlerianus Hay, (sp. nov.).

Body clongated, contracted behind ventral fins; dorsal region elevated. Mouth horizontal, small; maxillary extending to opposite anterior edge of pupil. Opercles with 2 rows of scales along lower edge; cheeks densely scaled; lateral line running high, extending to opposite end of anterior dorsal, on 18 scales. Pale greenish, yellow below; above and on sides much mottled with brown; about 10 square blotches along back; a dark spot on opercle, one behind and one below eye; a streak on snout between eyes; dorsals with dark markings; a red streak along margin of spinous dorsal; anal fin nearly white; caudal barred. Head 4 in length; depth  $5\frac{5}{6}$ . Eye  $3\frac{1}{2}$  in head. Caudal peduncle  $3\frac{3}{4}$  in body. D. IX-11; A. II, 6; scales 3-44-12. Black River, Mississippi. (Hay MSS.)

# **816. P. barratti** (Holbr.) J. & G.

Body comparatively short, chubby and compressed. Head rather large. Month large, oblique; the jaws equal, the teeth rather strong. Eye large, 3 in head. Scales large, varying in number. Lateral line beginning at the eye, arched high over the pectorals and ceasing about midway of the body, developed on about 20 scales. Opercular spine strong. Dorsal fins moderate, about equal, separated by an interspace. Color greenish, with dark specks; fins mottled; a dark line downward and one forward from eye; a series of rather small greenish blotches along each side and on the back. Head  $3\frac{3}{4}$ ; depth  $4\frac{3}{4}$ . D. X-12; A. II, 7; lateral line 45–55. L. 2 inches. Maryland to Illinois and southward; chiefly in streams of the lowlands.

(Bolcosoma barratti Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 56: Hololepis barratti Cope, Proc. Acad. Nat. Sci. Phila. 1864, 233: Hololepis barratti Vaillant, l. c. 127: Bolcichthys elegans Jordan, Amer. Lyc. Nat. Hist. N. Y. 1876, 308: Bolcichthys elegans Jordan, Man. Vert. 404, and probably of Girard, Proc. Acad. Nat. Sci. Phila. 1859, 104.)

<sup>\*</sup> Boleichthys Girard, Proc. Acad. Nat. Sci. Phila. 1859, 103: type Boleichthys cxilis Grd. ( $\beta o \lambda \iota \varepsilon$ , dart;  $i_{\lambda} \theta \dot{b} \varepsilon$ , fish.)

## 817. P. fusiformis (Grd.) J. & G.

Body moderately elongate, strongly compressed. Head rather long and narrow; muzzle short, decurved, shorter than the eye. Mouth comparatively large, terminal; maxillary reaching past front of eye. Eyes large, 4 in head. Opercular spine strong. Lateral line beginning at the eye, on about 12 to 15 scales. Neck sealy; belly and throat scaly. Olivaceous, dotted with dusky points; second dorsal and anal speckled. Head 4; depth 6. D. X-9; A. II, 7; Lat. l. 55. L. 2 inches. Massachusetts to New Jersey.

(Bolcosoma fusiformis Girard, Proc. Bost. Soc. Nat. Hist. v, 1854, 41: Hololepis fusiformis Cope, Proc. Acad. Nat. Sci. Phila. 1864, 233: Hololepis fusiformis Vaillant, l. c. 131: Bolcichtlus fusiformis Jordan, Man. Vert. 228.)

## 818. P. erochrous (Cope) J. & G.

Body elongate, compressed; the dorsal outline curved, the ventral nearly straight. Head long, decurved and narrowed in front. Month subinferior; the maxillary reaching past front of eye. Eye 4 in head, greater than length of snont. Opercular spine strong. Lateral line developed on about 16 scales. General color rather dark; blackish above; a black streak on muzzle and one downward from eye; a dark band, irregularly notched, along the sides, besides dark specks; caudal barred; the sides along the lateral band marked by red dots in life. Head 4; depth 6. D. IX-10; A. II, 7; Lat. l. 43. L. 2 inches. Streams tributary to Delaware and Chesapeake Bays. (Vaillant.)

(Hololepis erochrous Cope, Proc. Acad. Nat. Sci. Phila. 1834, 233: Hololepis erochrous Vaillant, I. c. 133: Boleichthys erochrous Jordan, Man. Vert. 228.)

# 819. P. cos Jordan & Copeland.

Body elongate, slender, somewhat compressed, especially behind, rather heavy forwards, with very long and slender caudal peduncle. Head long, rounded in front. Month small, little oblique, the upper jaw a very little the longer. Dorsal fins high, about equal; caudal truncate. Cheeks, opereles, and neck closely scaled. Breast naked, or with a median series of small scales. Lateral line developed on 22 to 26 scales. Color dark olive, with darker markings; 10 or 12 dark dorsal spots or bars, and as many short dark-blue bars across the lateral line nearly opposite the dorsal bars, but not continuous with them; the interspaces between these bars, as well as most of the ventral region, bright crimson in the males, nearly plain in the females; lower parts of the sides, cheeks, etc., with various sharply defined but irregular black markings; second dorsal, caudal, and pectorals strongly marked with

wavy bands; first dorsal bright blue in the males, with a broad median band of crimson; speckled in the females; top of head dark; black streaks downward and forward from eye. Head 4; depth 5½. D. IX-11; A. H. 7; Lat. l. 58. b. 2½ inches. Indiana to Minnesota; abundant in clear cold streams; one of the prettiest of the darters.

(Boleichthys cos Jordan & Copeland, Proc. Acad. Nat. Sci. Phila, 1877, 46: Boleichthys cos Jordan, Man. Vert. 228.)

gg. Cheeks naked; opereles scaly.

## 820. P. exists (Grd.) J. & G.

Body compressed, tapering towards the caudal peduncle, which is slightly contracted. Eye large, subcircular,  $3\frac{1}{2}$  in head; maxillary reaching anterior edge of pupil. Lateral line nearer the dorsal than the abdominal outline; pectorals extending further than the ventrals. Yellowish-brown, speckled with grayish-black, dorsals and caudal barred; a dark spot on the occipital region and a streak in advance of as well as beneath the orbit. Head  $4\frac{1}{4}$  (with caudal). D. X-10; A. II, 8. L.  $1\frac{3}{4}$  inches. Little Muddy River, a tributary of the Upper Missouri. (Girard.) Differs from P. con in the naked cheeks.

(Boleichthys exilis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 103.)

### 821. P. warreni (Grd.) J. & G.

"Resembles P. exilis more than any of its congeners by the shape of the body and the general appearance. It differs by a more compact body, a proportionally shorter head, smaller scales, and the number of fin rays. Ground color yellowish-brown, the middle of the flanks maculated with transverse spots of blackish; the belly exhibiting a rather orange hue; the first dorsal has a series of vertically elongated black spots resembling a dark band across the middle of the fin; the second dorsal and candal are transversely multilineated. A black streak may be seen in advance of the orbit and another beneath it." D. IX-II; A. II, 9. L. 2 inches. Cannon Ball River. (Girard.) Perhaps identical with the preceding.

(Boleichthys warreni Girard, Proc. Acad. Nat. Sci. Phila, 1859, 104.)

### 822. P. gracillis (Grd.) J. & G.

Slender and graceful; first dorsal lower and longer than the second; anal much deeper than long; tips of the ventral fins extending a little further back than those of the pectorals. Olivaceous, spotted with blackish; second dorsal and candal barred; a longitudinal black streak in advance of the orbits and a vertical one beneath them. Head 4½

(with eandal). D. X. 10: A. S. L. 13 inches. Rio Seco and Rio Leona. (Girard.) The types of this species, examined by us, have the lateral line incomplete and the premaxillaries not protractile.

(Boleosoma gracile Girard, Proc. Acad. Nat. Sci. Phila. 1859, 103.)

\*\* Dorsal spines 6: anal spines obsolete? (Alvarius\* Girard.)

## 823. P. lateralis (Grd.) J. & G.

"A representative of the Etheostomoid family was procured by the United States and Mexican Boundary Commission at the Rio Grande del Norte (Rio Bravo). It constitutes a new generic type allied to Catonotus, and to which we have applied the name of Alvarius, with the following characters. Head elongated and tapering. Mouth terminal, large, not protractile; lower jaw longer than the upper. Teeth very minute. Opercular apparatus, cheeks, and throat scaly. First dorsal nearly equal in height to the second, from which it is quite distinct. Anal fin much smaller than the second dorsal; caudal fin truncated; five soft rays to the ventrals. Ventral scales uniform." Body slender, elongate. Head subconical and tapering forward. Eye equal to snout, 4 in head. Maxillary reaching pupil. First dorsal about equal to second and separated from it. Anal smaller than second dorsal, the last rays of the two fins opposite each other. Scales very small. Lateral line median. Brownish, back spotted; sides with a narrow blackish streak, which extends around the snout; first dorsal with a black spot on its upper posterior edge; caudal transversely barred. D. VI, 10; A. S. L. 13 inches. Rio Grande. (Girard.)

(Alvarius lateralis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 101.)

#### 267.-MICROPERCA Putnam.

(Putnam, Bull. Mus. Comp. Zool. I, 1833, 4: type Microperca punctulata Putn.)

Body rather short, compressed. Month moderate, the jaws about equal. Premaxillaries not protractile. Vomerine teeth present. Gillmembranes scarcely connected. Scales large. Lateral line obsolete. Dorsal fins small, subequal, well separated, the first with six or seven spines; anal fin much smaller than second dorsal, with two well-developed spines. Color greenish, with dusky markings. Size very small, probably the smallest of the spiny-rayed fishes. (μιχρος, small; περιχη, perch.)

### 824. M. prœliaris Hay.

Body short and stout. Snout conical, pointed; jaws equal; mouth

<sup>\*</sup>Alvarius Girard, Proc. Acad. Nat. Sci. Phila. 1859, 101: type Alvarius lateralis. (A coined name without meaning.)

small, slightly oblique, maxillary reaching front of eye. Eye small, 4 in head. Cheeks and opercles with large scales. Opercular spine well developed. Scales large, the tubes of the lateral line developed on two of them; dorsals well separated. Anal spines slender, high; pectorals and ventrals reaching about to vent. Olive, speckled with brown; ten brownish spots along the sides; black streaks downward and forward from eye; dorsal fins mottled. Ilead 4; depth 4½. D. VIII, 11; A. II, 6. Lat. l. 36. L. 1½ inches. Alabama and Mississippi.

(Hay, Proc. U. S. Nat. Mus. 1880, 496.)

## 825. M. punctulata Putnam .- Least Darter.

Body rather short and deep, somewhat compressed, the back arched. Candal peduncle rather long. Head moderate. The snout somewhat decurved. The mouth moderate, terminal, oblique. Checks naked. Opercles somewhat scaly. Opercular spine very small. Neck and chest naked. No trace of lateral line. The usual series of tubes along the temporal region. Scales quite large, strongly etenoid. Vertical fins short. Anal spines strong, the first usually the largest. Coloration olivaceous, the sides closely speckled and with vague bars and zigzag markings; second dorsal and caudal barred; dark streaks radiating from eye; a dark humeral spot. Head  $3\frac{3}{4}$ ; depth  $4\frac{1}{2}$ . D. VI–VII, 10; A. II, 6; Lat. I. 34. L.  $1\frac{1}{2}$  inches. Smallest of the darters, and one of the smallest of fishes, abounding in the clear streams of the Northwestern States.

(Putnam, Bull. Mus. Comp. Zoöl. i, 1863, 4; Jordan, Man. Vert. 229.)

### 268.-PERCA Linnæus.

#### Pereh.

(Artedi: Linnæus, Systema Naturæ: type Perca fluviatilis L.)

Body oblong, somewhat compressed, the back elevated. Cheeks scaly; opercles mostly naked; the operculum armed with a single spine. Preopercle and shoulder girdle serrated. Mouth moderate, terminal; premaxillaries protractile; teeth in villiform bands on jaws, vomer, and palatines; no canine teeth. Branchiostegals 7. Gill-membranes separate; pseudobranchiæ small, but perfect; no anal papilla. Scales rather small, strongly etenoid. Lateral line complete. Dorsalfins entirely separate, the first of 12–15 spines; anal fin with two slender spines; caudal emarginate; air-bladder present. Pyloric caca 3; vertebræ (P. fluviatilis) 21+20. Fresh waters of northern regions; three species now known: P. fluviatilis in Europe, P. schrencki in Asia, and P. americana. This genus has long been considered the type of the

spiny-rayed fishes, and in many systems it has been placed first in the series of fishes. ( $\pi \xi \rho z \eta$ , Perca, the ancient name of P. fluviatilis, from  $\pi \xi \rho z \sigma z$ , dusky.)

## 826. P. americana Schranck.-Yellow Perch; American Perch; Ringed Perch.

Back dark olivaceous; sides golden yellow; belly pale; sides with 6 or 8 broad dark bars, which extend from the back to below the axis of the body; lower fins largely red or orange; upper fins olivaceous; usually no distinct black spot on anterior or posterior part of spinous dorsal. Back highest at origin of spinous dorsal, which is more or less behind insertion of pectoral; profile convex from dorsal to occiput, thence concave anteriorly, the snout projecting. Mouth somewhat oblique, maxillary reaching opposite middle of orbit. Cheeks closely scaled throughout, the scales imbricated; opercular striae and rugosities on top of head well marked. Pseudobranchiæ quite small. Gill-rakers stout, shortish. Head 3½ in length; depth 3½. D. XIII-I, 14; A. II, 7; scales 5–55–17. Fresh waters of the Eastern United States; chiefly northward and eastward; abundant.

This species has been recently considered as a slight variety of the European Perca fluviatilis. It is, however, distinguished by the following characters: The head in P. americana is rougher, the operele more strongly striate, the bones generally with finer and more numerous serræ; the preorbital is serrate, the scales on the cheeks are larger, imbricated and distinctly etenoid; the maxillary extends to opposite the middle of the pupil. The gill-rakers are stout, the longest but three times as high The pseudobranchiae are much smaller than in P. fluviatilis. as broad. First spine of the dorsal over or behind the posterior edge of the opercle, a series of scales downward from it reaching about to base of pectoral. In P. fluciatilis the dorsal is further forward, and the anterior spines are considerably higher than in *P. americana*. The scales are usually larger in the American species, the dark bars are more sharply defined, and the black spot on the membrane of the last dorsal spines, well defined in P. fluriatilis, is usually wanting. The most important characters, the difference in the insertion of the dorsal, and in the gill-rakers and pseudobranchia, have not been noticed by those writers who have decided that our species is identical with the European.

(Perca americana Schranek, about 1790, fide Gill: Bodianus flavescens Mitch. Trans. Lit. & Phil.Soc. N. Y. 1815, 421: Perca flavescens Holbrook, Ichth. S. C. 1860, 2: Perca flavescens, acuta, and gracilis Giinther, i, 59-60: Perca flaviatilis var. Steindachner, Sitzungsber. Wiener Akad. 1878.)

#### 269.—STIZOSTEDIUM Rafinesque.

#### Pike Perches.

(Lucioperca Cuvier: Centropouns Bleeker.)

(Stizostedion Rafinesque, Ichth. Oh. 1820, 23: type Perca salmonea Raf.)

Body slender, elongate, fusiform. Head subconical, long. Cheeks and opercles more or less scaly; top of the head with some scales. Mouth large, the jaws about equal; premaxillaries protractile, little movable. Teeth in villiform bands, the jaws and palatines with long, sharp canines. Gill-rakers slender, strong; gill-membranes separate. Preopercle serrated; opercle with one or more spines, terminations of radiating striae. Dorsal fins separate, the first with 12 to 15 spines; anal spines 2, slender; ventral fins not close together. Scales small, strongly etenoid; lateral line continuous. Pseudobranchia well developed. Pyloric cœca 3 to 7. Large earnivorous fishes of the fresh waters of North America and Europe; two strongly marked species on each continent. (στιζω, to prick; δτεθιω, a little breast; "the name means pungent throat," according to Rafinesque.)

a. Pyloric ecca 3, subequal, all about as long as the stomach. (Stizostedium.)

827. S. vitreum (Mitch.) Jordan & Copeland.—Wall-eyed Pike; Dory; Glass-eye; Yellow Pike; Blue Pike; Jack Salmon.

Dark olive, finely mottled with brassy, the latter color forming indistinct oblique lines; sides of head more or less vermiculated; lower jaw flesh-colored; belly and lower fins pinkish; spinous dorsal with a large jet-black blotch on the membrane of the last two or three spines, otherwise nearly plain; second dorsal and caudal mottled olive and yellowish; base of pectorals dusky without distinct black blotch. Body slender, becoming compressed with age, the back more arched than in *S. canadense*. Dorsal spines high, more than half length of head; soft dorsal nearly as long as spinous dorsal. Head  $3\frac{3}{3}$ ; depth about  $4\frac{1}{2}$ . Eye shorter than snout,  $4\frac{1}{2}$ -5 in head. D. XIII-I, 21; A. II, 12; Lat. I. 90. Pyloric coea 3, rather long. Great Lake region, Upper Mississippi, and some Atlantic streams, north to the fur countries; an abundant and valued food-fish, reaching a length of nearly 3 feet and a weight of 10 to 20 pounds.

(Perca vitrea Mitch. Sup. Amer. Mouth. Mag. ii, 247, 1818; Lucioperca americana Cuv. & Val. ii, 122; Lucioperca americana Günther, i, 74; Jordan, Bull. U. S. Nat. Mus. x, 46; Perca salmonca Raf Amer. Month. Mag. v, 354, 1818; Stizoste hium salmoncum

Jordan, Bull. U. S. Nat. Mus. x, 47: Stizostethium vitreum var. salmoncum Jordan, Man. Vert. ii, 230, the "Blue Pike," a local variety in Ohio and southward; bluer, with the body shorter and deeper, the size smaller.)

aa. Pyloric ceca small, unequal, 4 to 7 in number. (Cynoperea Gill & Jordan.\*)

828. S. canadenset (Smith) Jor.—Sauger; Sand-pike; Gray-pike; Horn-fish.

Olive gray above, sides brassy or pale orange, with much dark mottling; young pale orange with large dark lateral shades; spinous dorsal with 2 or 3 rows of round black spots; no distinct black blotch on the posterior part of the fin; a large black blotch at base of pectorals; second dorsal with about 3 rows of irregular dark spots; caudal dusky and yellowish. Body elongate, more terete than in the preceding. Head quite pointed, depressed, about 3½ in length; depth 4½–5. Eye small, 5 in head. Opercular spines varying in number and size. D. XIII-I, 18; A. II, 12; Lat. l. 95. Pyloric cœca 4–7, smaller than in S. vitreum. L. 15 inches. Great Lake region, Upper Mississippi and Ohio Rivers.

(Lucioperca canadensis C. H. Smith, MSS, in Griffith's edition Cuvier's Animal Kingdom, x, 275, 1836: Lucioperca canadensis Günther, i, 75: Lucioperca grisca DeKay, N. Y. Fanna, Fishes, 1842, 19; Lucioperca grisca Günther, i, 76; Jordan, Bull. U. S. Nat. Mus. x, 48: Lucioperca borca Grd., Proc. Acad. Nat. Sci. Phila. 1857.)

# FAMILY LXXXVL—SERRANIDÆ.

(The Sea Bass.)

Body oblong or elongate, more or less compressed, covered with adherent, etenoid (rarely smooth) scales of moderate or small size. Mouth horizontal or little oblique, usually large. Premaxillary protractile. Maxillary broad, with or without a supplemental bone, its posterior part not slipping under the edge of the preorbital. Jaws with bands of teeth, some of the teeth sometimes enlarged and canine-like; no incisors nor molar teeth; vomer and palatines with bands of villiform teeth; tongue sometimes with teeth; pterygoids toothless. Gill-rakers usually stiff and rather long, armed with teeth. Gills 4, a long slit behind the fourth. Pseudobranchiæ large. Lower pharyngeals separate, rather narrow,

<sup>\*</sup>Jordan, Bull. U. S. Nat. Mus. x, 48: type Lucioperea canadensis Smith.  $nuo\nu$ , dog;  $\pi\varepsilon\rho\nu\eta$ , perch.

<sup>†</sup>Three varieties of this species may usually be recognized:

a. Var. canadeuse, of the St. Lawrence region, with the opercles and bones of the head considerably rougher, the number of opercular spines, which are merely the free ends of the striæ, increased; the head is also more closely and extensively scaly;

b. Var. griscum (DeKay), the common form of the Great Lake region, described above; and

c. Var. boreum Grd. from the Upper Missouri region, with the head slenderer.

These forms intergrade and are doubtless varieties of the same species.

with pointed teeth. Gill-membranes separate, free from the isthmus. Branchiostegals 7 or 6. Cheeks and opercles scaly; preopercle with its posterior margin usually more or less serrate; opercles usually ending in one or two flat points or spins. Nestrils double. Lateral line continuous, single, not running up on the caudal fin (except in *Centropomus*). Skull without cranial spines, not cavernous. No suborbital stay. Dorsal fin variously developed, continuous or divided, the spines generally stiff. Anal fin rather short, with 3 spines, which are rarely reduced in number or obsolete. Ventrals separate, throacic, I, 5. Pectorals well developed. Candal fin truncate, rounded, or moderately forked, its peduncle stout and not keeled. Vertebræ about 25. Air-bladder present, usually rather small, and adherent to the walls of the abdomen. Intestinal canal short, with several or many pyloric appendages; the stomach cœcal.

Genera 40; species about 300. Carnivorous fishes, chiefly marine, and found in all warm seas; a few in fresh waters.

As here understood, the *Scrranidæ* comprises the most of the family of *Percidæ* as understood by Günther and others, exclusive of those with imperfect pseudobranchiæ, those with one or two anal spines and with the number of vertebræ increased, those in which the whole length of the maxillary slips under the preorbital, and the forms related to *Priacanthus*. Even after these eliminations the family is considerably varied. The definition of genera in this group offers many difficulties.

(Percida, groups Percina, Serranina, exclusive of eertain species, Günther, i, 61-220: Serranida, Labracida, Centropomida, Gill.)

- \*Anal spines strong; dorsal spines several.
  - †Branchiostegals seven.
    - a. Teeth all villiform, without canines.
      - b. Caudal fin deeply forked; dorsal divided.
        - c. Tongue toothless; supplemental maxillary present. (Centropomina.)
        - ce. Tongue with teeth; supplemental maxillary wanting. (Labracina.)
      - bb. Caudal fin not forked.
        - e. Tongue toothless; head scarcely armed.
          - f. First dorsal of 10 spines, depressible in a groove. Stereolepis, 272.
        - ee. Tongue with teeth; head well armed.
          - g. Dorsal continuous; a rough ridge on the operculum.

Polyprion, 273.

- aa. Teeth not all villiform, some of them more or less enlarged and canine like. (Serraniae.)
  - h. Maxillary without distinct supplemental bone; lateral canines usually stronger than those in front.....Serranus, 274.
  - hh. Maxillary with a distinct supplemental bone; anterior canines strongest; inner series of teeth depressible.

i. Cranium with only the median crest developed: anal rays about III. 9 . . . . Epinephelus, 276.

hhh. Maxillary unknown: "pyloric coca innumerable."

Promicrops, 277.

\*\* Anal spines obsolete or reduced to 2: scales very small, smooth. (Rhunticing.)

## 270.—CENTROPOMUS Lacépède.

(Ornlabrax Bleeker )

(Lacépède, Hist, Nat. Poiss, iv. 248, 1802; type Sciana undecimalis Bloch.)

Body elongate, covered with rather small, etenoid scales. oblong-conical, depressed, lower jaw projecting; teeth on jaws, vomer, and palatines, all villiform, without canines; tongue smooth. Maxillary with a strong supplemental bone. Preopercle serrated; two stronger spines at its angle; opercle without true spines; preorbital and suprascapular usually serrated. Dorsal fins entirely separated: the first with 8 spines; the first and second spines usually much shorter than the third. Anal fin short, with 3 spines, the second of which is long and Candal forked. Lateral line conspicuous, extending on the caudal fin. Branchiostegals 7. Species numerous, inhabiting tropical seas. According to Professor Gill the skeleton of Centropomus differs so widely from that of the other Serranoids that it should constitute a separate family. (zεντρον, spine; πῶμα, operculum.)

a. Lat. l. about 70; body clongate.

### 879. C. undecimalis (Bloch.) Cuv. & Val. -Robalo.

Silvery, greenish above; lateral line black, very distinct; dorsal and candal dusky; other fins yellowish; ventrals without dusky area. Preorbital nearly entire. Third dorsal spine longer than the fourth; second anal spine comparatively short, about as long as third. anteriorly with two long, slender, backward-directed horns. Head 3; depth 43. D. VII-I, 9; A. III, 6; Lat. l. 70. A large food-fish, abundant in the West Indies; ranging northward to Lower California, Florida, and Texas.

(Sciama undecimalis Bloch, Ichth. 303; Günther, i, 79; Vaillant & Bocourt, Miss. Sci. au Mex. iv, 17: Centropomus viridis Lockington, Proc. Cal. Acad. Nat. Sci. 1877, 16.)

### 271.-ROCCUS Mitchill.

Bass.

(Labras Cuvier, 1817; preoccupied in Chirida.)

(Mitchill, Rept. part, Fish. N. Y. 1814, 25: type Roccus striutus Mitch. = Sciana lincata Bloch.)

Body oblong or ovate, compressed and more or less elevated.

conical, scaly above and on sides. Mouth rather large, nearly horizontal; the jaws equal, or the lower projecting. Premaxillaries protractile; maxillaries large, without supplemental bone, only the edge of the anterior part slipping under the preorbital. Teeth all villiform, in bands, on jaws, vomer, palatines, and tongue. Eye large, orbital ridge a little elevated. Preopercle serrate behind and below; the teeth of its lower margin sometimes enlarged. Opercle with two flat spines. Preorbital narrow. Pseudobranchiæ large. Scales large. Breast scaly. Dorsal fins separate or connected at base, the anterior with 9 strong spines. Anal spines well developed. Caudal fin lunate. Pectorals small. Species about 6, in America and Europe, inhabiting both fresh and salt waters. (Name derived from the vernacular "Rock-fish.")

- a. Serræ on lower edge of preopercle small, not directed forwards.
  - b. Teeth on base of tongue; anal spines graduated; lower jaw projecting; scales on cheeks almost cycloid; dorsal fins separate.
    - c. Teeth on base of tongue in two patches; body elongate, little compressed. (Roccus Mitchill.)

## 830. R. lineatus (Bloch) Gill.—Striped Bass; Rock-fish; Rock.

Olivaceons-silvery; sides and below silvery white or brassy; sides marked with 7 or 8 longitudinal dark bands, one of which runs along the lateral line; the stripes usually continuous. Body elongate, little elevated; the young slender; axis of body about in the middle of the depth of the body. Month large, oblique; the large maxillary reaching to below the middle of orbit. Eye about half length of snout. Pectoral short, 1\frac{3}{4} in head. Spines slenderer than in the other species; the second anal spine \frac{1}{5} length of head. Head 3\frac{1}{2} in length; depth 3\frac{1}{2}. D. IX-I, 12; A. III, 11; Lat. l. 65. L. 3-4 feet. Atlantic coast; entering rivers; one of the largest and finest of our game fishes.

(Sciwna lineata Bloch, Ichth. ix, 53: Roccus lineatus Gill, Proc. Acad. Nat. Sci. Phila. 1860, 64: Labrax lineatus Holbrook, Ich. S. C. 1860, 24: Labrax lineatus Günther, i, 64.)

cc. Teeth on base of tongue in a single patch; body oblong, compressed. (Lepibema\* Raf.)

## 831. R. chrysops (Raf.) Gill.-White Bass.

Silvery, tinged with golden below the lateral line and with reddish above; sides with blackish or dusky longitudinal lines, 4 or 5 above the lateral line, one through which the lateral line runs, and a variable number of more or less distinct ones below it, the latter sometimes more or less interrupted or transposed. Dorsal outline much curved;

<sup>\*</sup>Rafinesque, Ich. Oh. 1820, 23: type Perea chrysops. ( $\lambda \varepsilon \pi \iota \xi$ , scale;  $\beta \eta \mu \alpha$ , stair; from "the scaly bases of the fins.")

second anal spine  $\frac{1}{3}$  length of head. Axis of body rather below the middle of its depth. Head conical, slightly depressed at the nape. Mouth small, nearly horizontal; maxillary reaching middle of pupil. Head about  $3\frac{1}{3}$  in length; depth about  $2\frac{1}{2}$ . Eye large, its diameter equal to the length of the snout. D. IX-I, 14; A. III, 12; Lat. l. 55. L. 15 inches. Great Lakes, Mississippi Valley, and northward. A game fish of some repute.

(Perca chrysops Raf. Ich. Oh. 1820, 28: Labrax multilineatus Kirtland, Bost. Jour. Nat. Hist. v, 21: Roccus chrysops Gill, Proc. Acad. Nat. Sci. Phila. 1830, II3: Labrax osculatii, multilineata, and notata Günther, i, 65, 67: Labrax albidus Dekay, New York Fauna, Fish. 1842, 13.)

- bb. No teeth on base of tongue; second anal spine enlarged; jaws equal; scales on cheeks etenoid; dorsal fins somewhat connected. (  $Morone^*$  Gill.)
  - d. Sides striped with black.

## 832. R. interruptus (Gill) J. & G.—Yellow Bass.

Brassy, tinged with olivaceous above; sides with 7 very distinct longitudinal black bands, darker than in the other species, those below the lateral line interrupted posteriorly, the posterior part alternating with the anterior. Body oblong-ovate, with the dorsal outline much arched. Head depressed, somewhat pointed, its profile concave. Eyes large, their diameter equalling length of snout. Mouth somewhat oblique, maxillary nearly reaching middle of orbit. Spines very robust; second anal spine  $\frac{2}{5}$  length of head. Dorsal fins little connected. Head 3 in length; depth  $2\frac{2}{3}$ . D. IX-I, 12; A. III, 9; Lat. l. 50. L. 1 foot. Mississippi Valley, chiefly southward; north to Illinois.

(Labrax chrysops Girard, U. S. Pac. R. R. Surv. Fish. 1858, 29; not Perca chrysops Raf.: Morone interrupta Gill, Proc. Acad. Nat. Sci. Phila. 1860, 118.)

dd. Sides not striped with black.

### 833. R. americanus (Gmel.) J. & G.-White Perch.

Olivaceous; sides silvery, with faint lighter streaks. Body oblongovate; dorsal outline much arched; the head depressed above eyes, and rather pointed. Mouth rather small, somewhat oblique, maxillary nearly reaching the vertical from the middle of the orbit. Eye moderate, its diameter about equal to length of snout. Spines strong, the second anal spine nearly ½ length of head. Dorsal fins considerably connected. Head 3 in length; depth about 3. D. IX-I, 12; A. III, 9;

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1860, 116: type Perca americana Gmel. Morone Mitch. Rept. Fish. N. Y. 1814, 18; is properly a synonym of Perca. (Meaning, if any, unknown.)

Lat. 1. 59. Length searcely a foot. Cape Cod to Florida, abundant, ascending all streams coastwise.

(Perca americana Gmel. Syst. Nat. I, pars iii, 1308, 1789: Labrax rufus Storer, Hist. Fish. Mass. 9: Morone americana Gill, Proc. Acad. Nat. Sci. Phila. 1830, 116: Perca mucronata Raf. Amen Month. Mag. ii, 205: Labrax americanus Holbrook, Ich. S. C. 5: Labrax rufus and pallidus Günther, i, 65, 67.)

## 272.—STEREOLEPIS Ayres.

### Jew Fishes.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 28: type Stereolepis gigas Ayres.)

Body oblong, somewhat elevated, little compressed. Head robust. the profile steeply elevated, the forehead broad and flattish. Edges of preopercle and interopercle serrate, becoming nearly entire with age. Crown, cheeks, and opercles sealy; snout, preorbital, and jaws naked. Scales small, not strongly ctenoid, their surface rugose with radiating striæ. Mouth large, wide, placed low; lower jaw prominent. Maxillary with a well-developed supplemental bone, extending to below the eye. Preorbital wide, only the anterior edge of the maxillary slipping Teeth all villiform, in broad bands, on jaws, vomer, and pal-Branchiostegals 7. Pseudobranchiæ very large. Gill-rakers very strong. Dorsal fin with 11 low, stout spines, the last spines very much shorter than the middle ones, and all depressible in a deep groove. Anal fin similar to soft dorsal, with 3 low, stout spines; caudal fin broad, nearly truncate; pectorals moderate; ventrals long. Pyloric Size enormous, among the largest of Percoid fishes. cœca about 7. (στερεός, firm; λεπις, scale.)

### 834. S. gigas Ayres.—Jew-fish; Black Sca Bass.

Brownish with large black blotches, becoming with age nearly uniform greenish black; vertical fins in the young with a conspicuous pale edge; ventrals black. Body and head robust; region from occiput to dorsal carinated. Soft parts of vertical fins scaly; spinous part naked; first dorsal spine prominent, curved. Ventrals reaching vent, one-fourth longer than the pectorals. Head 3; depth 3. D. X–I, 10; A. III, 8; Lat. l. 115. Pyloric ecca 7, long. L. 5 feet. Coast of California from San Francisco southward, not rare.

(Ayres, Proc. Cal. Acad. Sci. 1859, 28: Stereolepis californicus Gill, Proc. Acad. Nat. Sci. Phila. 1863, 330.)

#### 273.—POLYPRION Cavier.

### Stone Bass.

(Cuvier, Règne Anim. ii, 1817: type Polypriou cernium Val.)

Body robust, moderately elevated, covered with small, firm scales, which extend on the vertical fins. Mouth large, the lower jaw projecting. Teeth in villiform bands on jaws, vomer, palatines, and tongue. Preopercle serrate; orbital region with spinous projections; a strong, rough, bony longitudinal ridge on the opercle. Dorsal fin continuous, low, with 11 strong spines; caudal rounded; anal with 3 spines, the third the largest; ventrals large; pectorals short. Spines of anal and ventrals somewhat serrate on the anterior edge. Vertebra 13 + 13. Pyloric coeca about 70. Branchiostegals 7.  $(\pi o \lambda b z, many; \pi \rho v \dot{\omega} v, saw.)$ 

## 835. P. oxygenius (Schn.) J. & G.-Stone Bass; Wreck-fish; Cernier.

Grayish brown, the caudal edged with white; young clouded with light and dark. Body robust, somewhat compressed; the back elevated. Mouth rather large, the scaly maxillary extending to opposite the posterior margin of the eye; lower jaw the longer. Supraocular region, scapula, suprascapula, preopercle, and a ridge on opercle spinigerous. Anal spines short, serrate anteriorly, the third much the longest. Head 3; depth 2½. D. XI, 12; A. III, 8; L. 6 feet. A very large fish of the coasts of Southern Europe and Africa; a single young specimen lately obtained in deep water by the United States Fish Commission. It resembles Stereolepis, but is much rougher.

(Amphiprion americanus Bloch & Schneider, 205, t. 47, 1801; erroneously ascribed to America (nomen ineptum?): Epinephelus oxygeneios Bloch & Schneider, 301: Polyprion cernium Valenciennes, Mém. du Mus. xi, 265: Polyprion cernium Cuv. & Val. iii, 21, pl. 42: Polyprion cernium Günther, i, 169: Polyprion cernium Day, Brit. Fish. 17.)

### 274 .- SERRANUS Cuvier.

### Sea Bass.

(Cuvier & Valenciennes, Hist. Nat. Poiss, ii, 210, 1828: type Perca scriba L.)

Body oblong or moderately elongate, covered with rather small, etenoid scales. Scales of the lateral line quadrilateral or subtriangular, etenoid. Head oblong. Mouth wide, oblique. Maxillary without supplemental bone. Outer series of teeth more or less enlarged and canine-like, the canines sometimes very small, sometimes large, commonly numerous and developed along the sides of the lower jaw,

as well as along the front; teeth mostly fixed. Preopercle scrate behind; opercle ending in 2 flat spines. Cheeks and opercles scaly. Gillrakers shortish, stout. Fins little scaly. Dorsal fin continuous or emarginate, with 10 strong spines and 11-15 soft rays. Anal spines well developed. Caudal fin lunate or truncate. Occipital crests little developed. Pyloric cœca few. Vertebræ 10 + 14. Species very numerous in warm seas. Several modern genera are here included, some of which may perhaps merit restoration.

The typical species of Centropristis differs from Serranus seriba and its relatives in numerous respects, notably in the scarcely differentiated canines, the broader bands of teeth, the broader head, the stronger serræ on the operele, the rudimentary dorsal groove and nearly naked spinous dorsal (in Serranus proper, of which we have no typical species, there is no trace of a groove and the dorsal is more scaly), the larger scales, and the shorter soft dorsal. Each of these characters is shared with some of the species now referred to Serranus, and any line of division of the two groups is simply arbitrary, at least until the species are better known.

(Serran or serrano, a vernacular name; from the Latin serra, a saw.)

## 836. S. atrarius (L.) J. & G.—Black Fish; Black Sea Bass.

Dusky brown or black; more or less mottled, with traces of pale longitudinal streaks along the rows of scales; young greenish, often with a dark lateral band, sometimes broken up, forming cross-bars; dorsal fin with several series of elongate, whitish spots, forming interrupted lines; other fins dusky, mottled. Body ovate, robust, the back somewhat elevated; axis of body below the middle of the depth. Head large, thick, little compressed, somewhat pointed; top of head naked; cheeks and opercles scaly; scales on cheeks in about 11 rows. Mouth oblique, low, rather large, the premaxillary below the level of the eye; lower jaw prominent; maxillary broad, its upper edge auteriorly slipping under the edge of the broad preorbital, which is nearly as wide as the eye. Eye large, wider than interorbital space, less than shout,  $4\frac{1}{4}$  in head. Gill-rakers long. Canines very small, scarcely differentiated. Teeth all fixed, the bands rather broader than usual. Dorsal spines rather

<sup>·</sup> Caudal trilobate or trifurcate.

<sup>†</sup> Dorsal spines simple. (Centropristis \* Cuvier.)

<sup>&</sup>quot;Cuvier, Règne Anim. ed. 2. 1829: type Centropristis nigricans Cuv.=Perca atraria L. (χέντρον, spine; πριότης, saw.)

strong, not filamentous, the middle ones rather higher than the posterior, which are considerably lower than the soft rays, the highest spine as long as from snout to middle of eye. Anal short and high, its spines graduated. Pectoral very long,  $1\frac{1}{4}$  in head, reaching vent. Ventrals long, nearly reaching vent, inserted below front of base of pectorals. Caudal slightly double concave; fins little scaly, except at base; a rudimentary groove at base of spinous dorsal, over which scales do not pass. Head  $2\frac{3}{4}$ ; depth  $2\frac{3}{3}$ . D. X, 11; A. III, 7; Lat. l. 50; eœea 4–7. L. 12 inches. Cape Cod to Florida; generally abundant.

(Perca atraria L. Syst. Nat.: Centropristis nigricaus Cuv. & Val. iii, 37: Centropristis atrarius Günther, i, 86: Centropristis atrarius Holbrook, Ich. S. Car. 42.)

tt Dorsal spines produced in long filaments. (Triloburus\* Gill.)

## 837. S. trifurcus (Linn.) J. & G.

Grayish, with purple reflections; sides with 6 dusky gray vertical bars meeting across the back; silvery below; head bronze, with blue streaks in front of eye; dorsal shaded with olive, a large irregular black spot near its middle; dorsal filaments red. Body slender, little elevated, subfusiform. Mouth large, nearly horizontal, maxillary reaching to opposite middle of orbit. Preopercle finely and evenly serrated. Most of the dorsal spines and the three lobes of the caudal produced and filamentous. Head 3; depth about 4. D. X, 11; A, III, 8; Lat. l. about 55. South Atlantic coast; not very common.

(Perca trifurca Linn. Syst. Nat. i, 489: Centropristis trifurca Holbrook, Ich. S. Car. 1860, 49: Anthias furcatus Günther, i, 91.)

- \*\* Caudal Innate or truncate.
  - ‡ Serræ on lower limb of preopercle small, not antrorse.
    - a. Canine teeth small.
      - b. Dorsal fin continuous, none of the spines elevated.
        - c. Serræ at the angle of the preopercle forming one or two groups of radiating spines; soft dorsal rather short. (Diplectrum + Holbr.)

## 838. S. fascicularis Cuv. & Val.—Squirrel Fish; Serrano.

Brownish above, silvery below, sides marked with 7 or 8 longitudinal dark-blue lines; head marked with blotches and lines of dark blue; three or four distinct blue stripes across top of head; two across preorbital, the lower forked; fins barred with blue and pale yellow. Body elongate, not elevated. Head naked above; mouth rather large, maxillary narrow, nearly reaching posterior margin of orbit. Dorsal and

<sup>\*</sup> Gill, Cat. Fishes East Coast N. Am. 1831, 30; not characterized: type Perca trifurca L.  $(\tau \rho \varepsilon \tilde{\iota} \xi, \text{three}; \lambda o \beta \tilde{o} \xi, \text{lobe}, ; \tilde{o} v \rho \tilde{\alpha}, \text{tail.})$ 

tHolbrook, Ich. S. C. ed. 1, 32, 1859: type Serranus fascicularis C. & V. (δις, two;  $\pi\lambda\tilde{\eta}\mu\tau\rho\rho\nu$ , spur.)

anal spines slender, rather low, the former continuous with the soft rays; second anal spine small; caudal deeply emarginate; pectorals shortish, reaching tips of ventrals. Serræ of preopercle forming two diverging groups of long spines at its angle; lower limb of preopercle entire. Head 3; depth 4. D. IX, 12; A. II, 7; Lat. l. about 65. West Indies, north to South Carolina; not rare.

(Cuv. & Val. ii, 245; Centropristis fascicularis Günther, i, 83; Diplectrum fasciculare Holbrook, Icth. S. C. 1860, 35.)

cc. Serræ of preopercle simple. (Haliperca \* Gill.)
d. Soft dorsal of more than 13 rays.

## 839. S. subligarius (Cope) J. & G.

Chocolate-brown; cheeks, interopercle, maxillary, and mandible with a coarse network of white lines; yellowish below; body with 5 vertical cross-bands, 2 on the caudal peduncle and 2 above anal fin; pectoral and caudal with small brown spots; second dorsal and anal brown, with rows of small white spots. Form elongate-oval. Head narrow, conical; profile regular; mandible projecting; opercle with three points; maxillary smooth; cheeks and opercles scaly, those on the latter minute; scales on the vertex ceasing behind posterior margin of pupil. Median dorsal spines subequal; median anal spines extending beyond base of anal fin; caudal truncate. Teeth and armature of preopercle not described, but doubtless much as in 8. atravius. D. X, 14; A. III, 8; scales 53-48-18. Pensacola, Fla. (Cope.)

(Centropristis subligarius Cope, Proc. Acad. Nat. Sci. Phila. 1870, ---.)

bb. Dorsal fin emarginate, some of the anterior spines being elevated; soft dorsal long; preopercle simply serrate. (Paralabrax † Girard.)

### 840. S. cla(hratus (Grd.) Steind.—Rock Bass; Cabrilla.

Grayish green, with obscure, broad dusky streaks and bars, which form reticulations on the sides; sides often mottled or shaded with bluish or yellowish, but usually without distinct spots; a broad dark shade near axis of body, below which the color is nearly plain silvery gray. Preorbital narrow, its least width slightly more than half the diameter of the orbit. Maxillary broad, much expanded at tip, its greatest width two-thirds diameter of eye. Gill-rakers rather long, 22 below the angle. Pectorals long, 1½ in head; ventrals 1¾ in head; third, fourth, and fifth dorsal spines about equal, the second spine

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phíla, 1862, 233: type Serranus bivittatus C. & V.  $(\tilde{\alpha}\lambda^{\zeta},$  sea;  $\pi\dot{\epsilon}\rho\kappa\eta$ , perch.)

<sup>†</sup>Girard, Proc. Acad. Nat. Sci. Phila. 1856, 131: type Labrax nebulifer Grd. = Atractoperca and Gouloperca Gill.  $(\pi\alpha\rho\dot{\alpha}, \text{near}; \lambda\alpha\beta\rho\alpha\xi, Labrax.)$ 

half the length of the third, the third less than length of snout and orbit; second anal spine longest. Top of head mostly naked; a few scales along the median line behind the pupil. Head 3; depth 3½; eye 1¾ in snout. D. IX, I, 13; A. III, 7; Lat. l. 73. L. 18 inches. Coast of California; abundant southward.

(Labrax clathratus Grd. Proc. Acad. Nat. Sci. Phila. 1854, 143: Paralabrax clathratus Grd. U. S. Pac. R. R. Surv. 34: Paralabrax clathratus Günther, i, 62: Atractoperca clathratus Gill, Proc. Acad. Nat. Sci. Phila. 1861, 165.)

## 841. S. maculofasciatus Steindachner.—Cabrilla.

Olive brown, everywhere above thickly covered with dark hexagonal or roundish spots, which cover more space than the ground color, the latter forming reticulations around them; spots on back more or less confluent. most distinct and tinged with orange on sides of head, branchiostegals. and base of pectorals; about 7 oblique dusky cross-bars along the sides, in which the spots are deeper in color and more confluent; a bluish stripe from eye across cheeks; lips plumbeous; lower side of head yellow; spinous dorsal dusky, the membrane of third spine black; soft dorsal with bronze spots: eaudal with confluent dark spots at base and bronze spots at tip; other fins mottled with bronze and dusky. Preorbital very wide, wider than eve; maxillary narrow, reaching middle of pupil, its width about half that of eye; gill rakers short, 14 below angle of arch: pectoral short,  $1\frac{1}{2}$  in head; ventrals  $1\frac{3}{4}$ ; third and fourth dorsal spines elevated, the second two fifths the height of the third, which is longer than snout and orbit; second anal spine shorter than third; top of head sealed on the middle line to opposite front of pupil, naked on sides; eye half as long as snout. Head 3; depth 3. D. X, I, 14; A. III, 7; Lat. 1. 90 (72 pores). L. 12 inches. Coast of California, abundant from San Diego southward.

(Steindachner, Ichthyol. Notizen vii, 969, 1868; Vaillant & Bocourt, Miss. Sci. au Mex. iv, 72, 1874.)

### 842. S. nebulifer (Grd.) Steind.-Johnny Verde.

Greenish with irregular pale and dark mottlings and traces of dark oblique cross-bars, the colors having a washed or faded appearance; fins dull bluish black, mottled; lower side of tail with wavy whitish streaks; under side of head salmon color; preorbital, suborbital, and cheeks profusely marked with round orange spots; a dark streak downward and backward from eye; caudal mottled. Preorbital very broad, its least width about equal to the diameter of the eye; maxillary rather narrow, half as broad as the eye, reaching middle of pupil; gill-rakers shortish,

about 15 on lower part of arch; pectorals rather short, about  $\frac{2}{3}$  the length of the head; ventrals 2-2½ in head; first 2 dorsal spines very short, the third very high, much higher than any of the others; second spine one-third to one-fourth length of third, which is longer than snout and orbit; second anal spine as long as third; top of head closely scaled to beyond front of eyes. Head  $2\frac{3}{4}$ ; depth  $3\frac{1}{2}$ ; eye less than half the snout. D. X, I, 14; A. III, 7; Lat. l. 86. L. 18 inches. Coast of California, from Monterey southward; abundant.

(Labrax nebulifer Girard, Proc. Acad. Nat. Sci. Phila. 1854, 142: Paralabrax nebulifer Girard, U. S. Pac. R. R. Surv. x, 33, pl. xii: Paralabrax nebulifer Günther, i, 62; Steindschner, Ichthyol. Beiträge, iii, 1.)

## Serræ on lower edge of preoperele, large, spur-like, directed forward. (Plectropoma\* Cuvier.)

## 843. S. chlorurus (C. & V.) J. & G.—Negrita.

Color uniform blackish, strongly tinged with violet; pectoral and caudal yellow. Mouth rather large, the maxillary without supplemental bone, extending to the front of the pupil; lower jaw projecting; nine rows of scales on the cheek; preopercle finely serrate above, its lower margin withseveral antrorse teeth. Body elevated, somewhat compressed. Pectoral long, extending beyond ventrals; caudal forked; second and third spines of anal about equal. Head  $2\frac{1}{3}$ ; depth  $2\frac{1}{5}$ . D. X, 15; A. III, 7; Lat. l. about 65. West Indies, north to Garden Key, Florida.

(Plectropoma chlorurum Cuv. & Val. Hist. Nat. Poiss. ii, 406, 1828: P. chlorurum Giinther, i, 167: P. chlorurum Vaill. & Boe. Miss. Sci. Mex. iv, 104: Plectropoma nigricans Poey, Memorias Cuba, i, 71, 1851: Hypoplectrus nigricans Poey, Synopsis Pisc. Cubens, 290.)

#### 275.—TRISOTROPIS Gill.

(Parepinephelus Bleeker.)

(Gill, Proc. Acad. Nat. Sci. Phila, 1865, 104: type Perca guttata Bloch.)

Characters of *Epinephelus*, except that the lateral crests on the cranium are well developed, like the median one. "This genus is recognizable externally by its oblong form, the peculiar structure of the nostrils, the form of the fins, etc., but is more especially distinguished by the development of the skull, which differs in a very marked manner

<sup>\*</sup>Chvier, Règne Anim. ii, 142, 1829: type Bodianus maculatus Bloch. This group has been separated from Serranus on account of the strong antrorse teeth of the lower edge of the preopercle. It has been divided by Professor Gill into several genera, which have been adopted and defined by Professor Poey, but their necessity is not evident. It is at best an artificial group, and some of the current species (P. afrum, etc.) belong to Epinephelus.  $(\pi\lambda\tilde{\eta}\chi\tau\rho\nu r)$ , spur;  $\pi\tilde{\omega}\mu\alpha$  operculum.)

from that of Epinephelus. \* \* The skull differs from that of Epinephelus by the wider interorbital area, the parallelism and continuation of the lateral crests forward to the middle of the orbits inclosing an elongated parallelogram, the surface of which, especially between the orbits, is more uniform; the absence of a frontal crest, the simple curvature or straightness of the naso-vomerine ridge and absence of the angle at the suture between the nasals and vomer." (Gill.) The species of this group have the anal III, 11, or III, 12. They reach a very large size, and are abundant in the tropical seas. ( $\tau \rho \epsilon \bar{\tau} \epsilon$ , thrice;  $\tau \rho \delta \pi \epsilon \epsilon$ , a keel, in allusion to the presence of the three parallel elevated keels on the top of the cranium, which distinguishes this genus from Epinephelus.)

### 844. T. brunneus Poey.—Black Grouper; Abadejo.

Clear brown, covered with spots of darker brown, irregular in size and form; pectorals reddish; ventrals bluish; other fins dusky; maxillary with a supplemental bone; preopercle sinuous; third dorsal spine not a third as high as the body; soft dorsal highest at its middle. Head  $3\frac{1}{5}$  in total length; depth about 4. Eye  $7\frac{1}{2}$  in head. D. XI, 16; A. III, 11; Lat. l. about 110; cœca 15. (*Poey.*) West Indies, north to Virginia.

(Serranus brunneus Poey, Memorias Cuba, ii, 131, 1858; Goode & Bean, Proc. U. S. Nat. Mus. 1879, 143.)

### 945. T. falcatus Poey.—Scamp.

Brown, with irregular darker spots, none on the head or belly; pectorals edged with blackish and orange. Body moderately compressed. Maxillary reaching vertical from posterior margin of eye; lower jaw much projecting beyond the upper; upper jaw with teeth in a single series, with a short band in front; 4 canines; lower jaw with teeth in two series, and with several canines at the symphysis; teeth on vomer, in an angular patch; palatine teeth in a single series. Sixth dorsal spine longest; caudal deeply forked, the external rays nearly twice the length of the middle ones. Head  $2\frac{\pi}{9}$ ; depth about 3. D. XI, 17; A. III, 11; L. lat. 120; L. transv.  $\frac{25}{4\frac{5}{3}}$ . (Goode & Bean.) West Indies, north to Pensacola.

(Poey, Memorias, ii, 138; Goode & Bean, Proc. U. S. Nat. Mus. ii, 140, 1879.)

### 846. T. microlepis Goode & Bean.

Maxillary reaching perpendicular from posterior margin of orbit; each jaw with two canines; upper jaw with an inner series of villiform and an outer series of large slender conical teeth curved inward; lower jaw with two series of conical teeth, the inner the largest and movable; from and palatines with very small villiform teeth. Preopercle with fine denticulations on its posterior margin and some coarser ones at the angle. Third and fourth dorsal spines highest, the first slightly higher than the second. Color not described. Head  $2\frac{1}{2}-2\frac{2}{3}$ ; depth  $3\frac{1}{2}$ . D. XI, 18; A. III, 10; L. lat. 145; L. transv.  $\frac{30}{60}$ . (Goode & Bean.) Western coast of Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. ii, 1879, 141.)

### 276.-EPINEPHELUS Bloch.

Groupers\*; Merous.

(Bloch, Ichth. 1793; Bloch & Schneider, Syst. Ichth. 1801, 299; type Epinephelus ruber Bloch.)

Body stout, compressed, covered with small ctenoid scales, which are often somewhat embedded in the skin; 75-140 in the course of the lateral line; scales of the lateral line triangular, eycloid; soft parts of the vertical fins generally more or less scaly. Top of cranium narrow, with the median crest only developed, the lateral keels being obsolete. Preopercle moderately serrate behind, its lower limb nearly or quite entire, rarely with an antrorse spine; opercle with two strong spines. large; maxillary with a well-developed supplemental bone. teeth few, large, in the front of the jaws; enlarged teeth of the inner series of each jaw depressible. Gill-rakers short. Dorsal spines usually 9 or 11, not filamentous, the last ones somewhat shorter than the middle ones. Anal spines 3, the second usually the larger; the number of soft rays 7-9. Candal fin rounded. Pyloric cœca usually few (usually 10-Species very numerous, most of them of large size, abounding in all the tropical seas, where they are among the most valuable foodfishes. (ἐπινεφελος, clouded; in allusion to a supposed adipose membrane covering the eye.)

### 847. E. capreolus (Poey) J. & G.—Cabrilla.

Brown, everywhere covered with round dark spots regularly placed, largest below, smallest near the dorsal fin, those below about as large as the pupil; two larger black spots at base of spinous dorsal, partly on the fin; a few roundish pale spots on the body; fins all spotted; pec-

<sup>\*</sup> Dorsal spines 11.

a. Pyloric eœca less than 35. (Epinephelus.)

<sup>\*</sup>A corruption of the Portuguese name, Garrupa.

torals and ventrals finely mottled, the pectorals with a narrew pale edge. Body ovate, rather slender, the head long and pointed. Lower jaw slightly projecting; maxillary extending nearly to the posterior border of the orbit; four small canines in front of lower jaw. Preopercle slightly emarginate, its edge finely serrate. Scales small, those on cheeks, breast, and top of head very small. Caudal rounded; pectoral fin extending beyond tips of ventrals, to vent; second anal spine rather strong. Head  $2\frac{1}{3}$ ; depth 3. D. XI, 16; A. III, 7; Lat. l. about 80. Florida to the Caribbean Sea; abundant in the West Indies; an excellent food-fish. The synonymy of this species is much confused, and the name to be adopted is uncertain.

(? Perca maculata Bloch, Ichth. 181, taf. 343, 1797; not Holocentrus maculatus Bloch, Ichth. taf. 242, which is also apparently an Epinephelus: ? Sparus atlanticus Lacép. Hist. Nat. Poiss. iv, 158, 1802 (based on Bloch.): ? Serranus impetiginosus Miller & Troschel, Schomburgk, Excurs. Barbadoes. 665: ? Serranus maculatus and impetiginosus Günther, i, 130, 142: Serranus capreolus Poey, Memorias, ii, 145: Serranus capreolus Vaillant, Miss. Sci. au Mex. iv, 87.)

### 848. E. drummond-hayi Goode & Bean.-Hind; John Paw.

Color umber brown, everywhere densely covered with white stellate spots except on the lips and belly; about 40 of these between gill-openings and base of caudal; along the sides the spots often coalesce. Preopercle evenly serrate. Eye  $6\frac{1}{3}$  in head. Caudal truncate or slightly emarginate. Head  $2\frac{2}{3}$ ; depth  $2\frac{2}{3}$ . D. XI, 16; A. III, 9; scales 32-125-57. Gulf coast of United States. (Goode & Bean.)

(Goode & Bean, Proc. U. S. Nat. Mus. i, 174, 1878.)

### 849. E. morio (Cnv.) Gill.—Red Grouper.

Brownish, marbled with ash; salmon color below; soft parts of the vertical fins margined with blue. Body oval, compressed above; profile oblique, gently curved; mouth terminal, large, somewhat oblique; maxillary reaching beyond eye. Eye about as long as snout. Head  $2\frac{1}{2}$ ; depth 3. D. XI, 17; A. III, 9; Lat. l. 106; cœca 28. Atlantic coast, chiefly southward.

(Serranus morio Cuv. & Val. ii, 285: Serranus morio Günther, i, 142: Serranus erythrogaster Holbrook, 1ch. S. C. 1860, 34.)

### 850. E. migritus (Holbrook) Gill.—Black Grouper; Jew-fish.

Bluish black above, lighter below; no red; no traces of markings on body or fins. Body oblong, thick, tapering backward. Mouth large, very oblique, lower jaw projecting. A spine on the lower limb of the preopercle in front of the angle. Head  $2\frac{3}{3}$ ; depth about  $2\frac{3}{4}$ . D. X, 15;

A. III, 9; scales 24-115-52. Gulf of Mexico, north to South Carolina; reaches a weight of 300 pounds.

(Serranus nigritus Holbrook, Ich. S. C. 1860, 177: Serranus nigritus Günther, i, 134; Goode & Bean, Proc. U. S. Nat. Mus, 1878, 182.)

aa, Pylorie eœca numerous (50-70). (Hyporthodus\* Gill.)

### 851. E. niveatus (Cuv. & Val.) Poey.

Brownish olive; sides with many large, light blue spots, which are arranged in about 5 transverse rows; a large quadrangular black spot crossing caudal peduncle above and running down on sides to below the lateral line. Body oblong, compressed, highest forwards; mouth large, oblique, maxillary reaching beyond middle of orbit; lower jaw slightly the longest; membranes of vertical fins scaled half way up; second anal spine about as long as third and much stronger; top of head entirely scaled, except in front of nostrils. Eye large, as long as snout. Head  $2\frac{1}{2}$ ; depth  $2\frac{2}{3}$ . D. XI, 14; A. III, 9; Lat. l. about 85. West Indies to Florida; accidental northward.

(Serranus nireatus Cuv. & Val. ii, 380: Serranus nireatus Günther, i, 130: Hyporthodus flavicauda Gill, Proc. Acad. Nat. Sci. Phila. 1861, 98, from Newport, R. I.)

\*\* Dorsal spines 9. (Bodianus + Bloch.)

# 852. E. punctatus (L.) J. & G.—Butter-fish; Nigger-fish; Coney.

Olivaceous yellow or red, covered with small, round, dark-edged spots of blue; one or two black spots on the tip of the chin and one on the caudal peduncle; colors brilliant and variable. Maxillary not reaching posterior margin of eye; eye  $5\frac{1}{2}$  in head; preoperele finely serrate; its lower limb entire; caudal truncate; skull channelled between the eyes, its upper surface smooth. Head  $2\frac{3}{4}$ . D. IX, 15; A. III, 9; Lat. l. 85. Pyloric coca 8. Vertebrae 10+14. (Günther.) Size small; flesh soft. West Indies, north to Florida Keys; abundant.

(Perca punctata L. Syst. Nat. x, 291, 1758: Serranus ouatalibi Cuv. & Val. ii, 381, 1829 (red variety): Serranus ouatalibi Giinther, i, 120: Serranus guativere Cuv. & Val. ii, 383: Serranus carauno Cuv. & Val. ii, 383: Enneacentrus punctatus Pocy, Rep. Fis.-Nat. Cuba, 1868, 288: Enneacentrus punctatus Goode, Bull. U. S. Nat. Mus. v, 59.)

#### 277.-PROMICROPS Gill.

(Gill, MSS.; Poey, Synopsis Piscium Cubensium, 1868, 287; type Serranus quasa Poey.)

"This genus has the characters of *Epinephelus*, except the cranium, which resembles that of *Trisotropis* by the great interorbital width.

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1861, 98: type Hyporthodus fluricanda Gill = Serranus niveatus juv. ( $\mathring{v}\pi o$ , below;  $o\rho\theta o\varsigma$ , straight;  $\mathring{o}\delta o\tilde{v}\varsigma$ , tooth.)

<sup>†</sup>Bloch Ichthyol; Bloch & Schneider, Syst. Ichth. 1801, 330; type Bodianas guttatus Bloch. (From Bodiano, a Portuguese name of various similar fishes.)

We may notice the eye well advanced. It further differs in the dentition and by the extreme division of its pyloric appendages. The teeth are in a large band, a little narrower in the lower jaw; the external margin shows a row of teeth a little stronger, especially the two first, but there are no differentiated canines; the extreme inner series in front has some stronger teeth. The palatine and vomerine teeth are in finer bands. The cœca and their divisions are innumerable." (Poey.) Elsewhere the cranium is described as short, broad, and flat, the occipital crest very low. Size enormous, as in the genus Stereolepis. This genus and Trisotropis should probably be considered as sections of Epinephelus. ( $\pi\rho o$ , before;  $\mu\iota z\rho o \varsigma$ , small;  $\omega \psi$ , eye; in allusion to the shortness of the anterior part of the cranium, due to the advancement of the orbit.)

### 853. P. guasa Poey.-Guasa.

Yellowish olivaceous, with numerous brown spots. Body more compressed above than below. Mouth large, maxillary reaching beyond the orbit; preopercle feebly serrated; opercle with 3 flat points; fins all very low, caudal rounded. Head  $3\frac{1}{6}$ ; depth 4. D. XI, 16; A. III, 8. (*Poey.*) West Indies, north to Florida; reaches a weight of 400 or 500 pounds.

(Serranus guasa Poey, Mem. ii, 141, 1858.)

#### 278.—DULES Cuvier.

(Cuvier, Règne Anim. ed. 2d, ii, 1829: type Dules auriga C. & V.)

Body oblong, ovate, compressed and elevated, covered with rather large scales. Mouth large, the lower jaw projecting; the maxillary reaching to opposite the middle of the eye. Teeth moderate, the anterior in the upper jaw enlarged, wide-set, but hardly forming canines. Preopercle sharply serrate; opercle with 2 strong spines. Dorsal with 10 spines, anal with 3; the third dorsal spine filamentous, the second anal spine longest. Branchiostegals 6. Fishes of the warm seas, sometimes entering rivers. ( $\partial u \bar{\nu} \lambda u z$ , a slave; the fish being under the lash of the long dorsal spine.)

# 854. D. auriga Cuv. & Val.—Charioteer; Coachman.

Yellowish gray, with two or three darker cross-bands and faint dark longitudinal streaks. Opercle with two or three strong spines, the upper one the largest; pectoral and ventral fins large; third dorsal spine filamentous, reaching the middle of the candal; caudal truncate. D. X, 13; A. III, 7; Lat. l. 46. Vert. 10 + 14. Tropical parts of the Atlantic; said to have been taken on our coast.

(Cuv. & Val. iii, 112; Günther, i, 206.)

#### 979.-RHVPTICUS Cavier

# Soap-fishes.

(Cuvier, Règne Anim. ii, 1829: type Anthias saponaccus Bloch & Schneider.)

Body oblong, compressed, covered with small, smooth embedded scales. Mouth oblique, rather large, the lower jaw prominent, the maxillary with a supplemental bone, reaching to or beyond the pupil; preorbital rather narrow; no eanines; broad bands of villiform teeth on jaws, vomer, and palatines. Preoperele crescent-shaped, without angle or serratures, its margin with spinous teeth above. Opercle with spines. Dorsal fin with two or three low stout spines, sometimes separated by a notch from the soft rays; anal fin without spine, or with an embedded rudiment; caudal fin rounded behind. Ventrals small. Pectorals short and rounded. Tropical seas. (μοπτικός, washing; from the "soapy" skin.)

a. Dorsal spines 2, more or less connected with the soft rays. (Promicropterus\* Gill.)

### 855. R. maculatus Holbr.

Olive brown above, with scattered whitish spots; below pale slate color. Back regularly arched from snout to caudal fin. Mouth large, maxillary extending beyond orbit; lower jaw longer than upper, and projecting much beyond it in closed mouth. Preopercle with 2 stout spines; opercle with 3. Pectorals rather large. Vertical fins high. Dorsal spines slightly connected with the soft rays. Head 3\frac{1}{3}; depth 3. D. II, 25; A. 15. North Carolina to the West Indies.

(Holbrook, Ich. S. C. 1860, 42; Günther, i, 173.)

### 856. R. decoratus (Gill) J. & G.

Brownish, irregularly maculated with light spots about as large as the pupil, these generally with a blackish centre; the spots are sometimes confluent and are most numerous on the sides. Eye equal snout, 5½ in length of head. Head 3; depth 3½. D. II, 26; A. 16. Tropical seas; accidental at Newport, R. I. (Gill.)

(Promicropterus decoratus Gill, Proc. Acad. Nat. Sci. Phila. 1863, 164.

#### 857. R. pituitosus Goode & Beau.

Very light brown, with numerous small brown spots; the diameter of the largest, one-third that of eye; these absent on abdomen and throat; traces of light margins to the vertical fins. Upper jaw nearly reaching

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1861, 53: type Rhypticus maculatus Holbr.  $(\pi\rho\dot{o},$  before;  $\mu\nu\rho\dot{o}$ 5, small;  $\pi\tau\epsilon\rho\dot{o}\nu$ , fin.)

the vertical from posterior margin of orbit. One continuous dorsal; dorsal and anal fins higher posteriorly, the longest rays reaching base of caudal. Eye twice the length of snout. Head more than one third length of body; depth  $3\frac{1}{2}$ . D. II, 27; A. 15; Lat. l. 90; L. transv.  $\frac{9}{30}$ . (Goode & Bean.) Key West, Fla.

(Goode & Bean, Proc. U. S. Nat. Mus. ii, 341, 1879.)

# FAMILY LXXXVII.—PRIACANTHIDÆ

(The Big Eyes.)

Body oblong or ovate, compressed, covered with small, firm, rough scales; all parts of the body and head, even the snout and maxillaries, being densely scaly. Head deep. Mouth large, very oblique, the lower jaw prominent. Villiform teeth on jaws, vomer, and palatines, none on the tongue. Premaxillaries protractile. Maxillary broad, without supplemental bone, not slipping under the very narrow preorbital. Eye very large, forming about half the length of the side of the head. Posterior nostril long, slit-like. Preopercle more or less serrated, one or more strong spines at its angle; operculum very short, ending in two or three points behind. Gill-membranes separate, free from the isthmus. Pseudobranchiæ large. Gills 4, a slit behind the fourth. Gill-rakers long. Branchiostegals 6. Lateral line continuous. Dorsal fin continuous, with about 10 spines, which are depressible in a groove; anal spines 3, the soft part long, similar to the soft dorsal; ventrals large, thoracic, I, 5; pectorals small, rounded; caudal fin truncate or lunate. of fins generally rough with small serræ. Air-bladder large. Pylorie Small carnivorous fishes of the tropical seas; mostly rosecolored in life. Genus 1; species about 20.

(Percidæ, group Priacanthina Günther, i, 215-221.)

### 280.—PRIACANTHUS Cuiver.

### Big Eyes.

(Cuvier, Règne Anim. ii, 1817: type Priacanthus macrophthalmus Cuvier.)

Characters of the genus included above.  $(\pi\rho i\omega r, saw; \ddot{a}za\nu\theta a, spine;$  from the serrature of the spines.)

a. Body more than twice as long as deep; scales small. (Priacanthus.)

# 858. P. macrophthalmus Cav. & Val.—Big Eye.

Uniform red, fins edged with dusky. Body oblong, compressed, but little elevated. Gape of mouth subvertical, maxillary passing front of

eye. Head completely scaled. Eye about one-half length of head, more than 6 times width of preorbital. Ventrals long, reaching front of anal; pectorals small, not longer than eye. Lateral line following the curve of the back. Head 3½; depth 2¾. D. X, 14; A. III, 15; Lat. l. 85. West Indies: occasional on our coast.

(Cuy, & Val. iii, 95; Günther, i, 215.)

aa. Body not twice as long as deep: scales large. (Pseudopriacanthus Bleeker.)

#### 859. P. altus Gill.

Nearly uniform orange-red in life; vertical fins dotted with black; ventrals black. Body oblong, compressed and elevated. Profile very oblique; snout extremely short; gape of mouth very oblique, maxillary reaching to below orbit. Eye about one-half length of head. Spines stouter than in *P. macrophthalmus*. Scales much larger and rougher. Lateral line running obliquely upwards in front, then abruptly turning downwards. Ventrals large, extending beyond origin of anal. Preopercle and opercle coarsely serrate at angle and on lower limb; angle of preopercle with 2 spines, upper limb simply roughened. Caudal fin rounded. Head  $2\frac{1}{2}$ ; depth  $1\frac{1}{2}$ . D. X, 11; A. III, 9; Lat. l. 45. Coast of New England; not common.

(Priacanthus altus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 132.)

# FAMILY LXXXVIII.—SPARIDÆ.\*

(The Sparoid Fishes.)

Body oblong, more or less elevated, covered with moderate-sized adherent scales, which are generally more or less strongly etenoid, sometimes almost cycloid ("sparoid"). Head large, the skull often with traces of the cavernous structure seen in *Scianida*. No suborbital stay. Mouth moderate or large, terminal, low, nearly horizontal. Premaxillaries protractile; maxillary without supplemental bone, for its whole length, slipping into a sheath formed by the edge of the broad preorbital; teeth villiform, cardiform, incisor-like or molar; canines sometimes present; vomer, palatines, and tongue with or without teeth; gills 4, a large slit behind the fourth; pseudobranchiae large; gill-rakers moderate; branchiostegals 4–7; gill-membranes separate, free from the isthmus. Edge of preopercle serrated or entire; opercle usually without spines; sides of head generally scaly. Dorsal fin continuous or deeply notched,

<sup>\*</sup>Including 87 Pristipomatida, and 88 Sparida of the artificial key to families, on page 77.

Bull. Nat. Mus. No. 16-35

the spines strong, usually depressible into a groove. Anal fin similar to soft dorsal, with 3 spines. Ventrals thoracic, I, 5, commonly with an ac cessory scale-like appendage. Caudal fin rounded or forked. Lateral line continuous, not extending upon the caudal fin. Pyloric coca few or many. Air-bladder present, usually simple. Genera 55; species about 450, abounding in the seas of temperate and tropical regions. Those with incisor teeth only are chiefly herbivorous, the others carnivorous. The three principal subdivisions given below have been often taken as separate families.

(Sparidw, Pristipomatidw and Percidw pts. Günther, i, 175-211, 272-339, and 412-499, exclusive of certain genera.)

- a. Teeth all conical and pointed; no incisors nor molars, preopercle serrate; pyloric coca few; carnivorous.
  - b. Vomer with teeth.
    - e. Dorsal fin deeply emarginate; teeth all villiform, in narrow bands. (Xenich-thyinæ)........................ХЕМІСИТНҮS, 281.
    - cc. Dorsal fin continuous; canines more or less developed. (Lutjanina.)

bb. Vomer, palatines, and tongue toothless.

- $d_{\bullet}$  Dorsal fin continuous.
  - e. Caudal fin lunate or forked; profile convex. (Pristipomatina.)
    - f. Month small; dorsal and anal fins naked or scaly at base only.

Pomadasys, 283.

Lutjanus, 282.

ff. Mouth large; soft parts of dorsal and anal densely scaly throughout.

Diabasis, 284.

- ee. Candal fin convex; profile concave. (Lobotine.)
  - h. Jaws with bands of villiform teeth, in front of which are a series of larger ones; no teeth on vomer or palatines.

Lobotes, 285.

- aa. Teeth on the sides of the jaws molar; preopercle entire; pyloric ceea few; no teeth on vomer, palatines, or tongue; carnivorous. (Sparina.)
  - j. Front teeth conical, not at all compressed................Sparus, 286.

m. Vomer toothless; fins mostly scaleless. (Girelling.)

- Vomer toothless; fins mostly scaleless. (Girelling.)
   n. Incisors trifid; cheeks scaly; opercles naked; dorsal
- - m. Vomer with teeth; soft fins densely scaly; incisors lanceolate. (Pimelepterinw)
    - Incisors with horizontal backward-projecting roots, the band of small teeth behind them narrow.

Pimelepterus, 289.

#### 281.—XENICHTHYS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 82: type Xenichthys xanti Gill, from Lower California.)

Body moderately elongate, subfusiform, compressed; head conic, little compressed; eyes large, anterior; preorbital rather narrow, oblique;

preoperculum pectinate behind; mouth rather small, very oblique; chin much projecting, a pore on each side of it at the symphysis; teeth very small, recurved, in narrow bands in each jaw; vomer with a rhomboid patch of very minute teeth; palatines nearly toothless; tongue slightly rough; branchiostegals 7; pseudobranchiae present; scales small, firm, etenoid; lateral line continuous; dorsal fins separate or connected by a low membrane; the first received into a groove, and composed of about 10 slender but rigid spines; second dorsal low; anal fins with 3 graduated spines and 10 to 20 rays; caudal fin emarginate, with rounded lobes; ventrals with a pointed axillary scale. Pacific Ocean. ( $\xi \epsilon \nu n \varepsilon$ , strange;  $i\gamma \theta b \varepsilon$ , fish.)

a. Anal fin not elongate.

### 860. X. californiensis Steindachner.

Silvery, with continuous dusky stripes along the rows of scales on the upper half of the body, 3 above the lateral line, 4 or 5 below. oblong, not elevated nor much compressed; mouth moderate, terminal, very oblique, the lower jaw strongly protruding; premaxillary in front above the middle of the large eye; maxillary not very broad, reaching opposite front of pupil; eye 31 in head, longer than snout. Teeth in jaws villiform, in a very narrow band; on the vomer scarcely appreciable; edge of preopercle finely serrate; no opercular spine; ventrals with a large accessory scale; gill-rakers very long and slender; pseudobranchiæ large; scales small, firm, quite rough, covering the top of the head, cheeks, and most of the preorbital, which is rather narrow; soft parts of vertical fins well sealed; spinous dorsal depressible in a groove, the spines stiff; the two dorsals almost separate; second spine highest, the others regularly shorter; soft dorsal low; candal forked; second and third anal spines high. Pectoral falcate, \(\frac{3}{4}\) length of head, reaching beyoud the tips of the rather short ventrals. Head 3\frac{1}{2}; depth 3\frac{1}{2}. D. 1X-I, 12; A. III, 10; Lat. l. 52. Pacific coast, from San Diego southward. Here described from specimens collected by Dr. Streets at Cerros Island. (Steindachner, Ichth. Beiträge, iii, 3, 1875; Streets, Bull. U. S. Nat. Mus. vii, 49.)

282.-LUTJANUS Bloch & Schneider.

Snappers.

(Mesoprion Cuvier: Diaeope Cuvier: Genyoroge Cantor.)

(Bloch & Schneider, Systema Ichthyol. 1801, 324: type *Lutjanus lutjanus* Bl. & Schn.)

Body oblong, compressed, the back somewhat elevated; head long; mouth large, the jaws with bands of villiform teeth, besides which are

usually an outer series of larger teeth in each jaw, and 2-4 stronger teeth or canines in the front of the upper jaw; vomer with villiform teeth; villiform teeth on the palatines and in one or more patches on the tongne; preopercle sometimes with a notch posteriorly, into which a knob on the interopercle fits (*Diacope*); posterior limb of preopercle finely serrate; gill-rakers moderate, strong; branchiostegais 7; vertical fins not much scaly; dorsal spines 10-12; caudal lunate or forked. Vertebre 10 + 14. Species very numerous, in all warm seas. (*Lutjang*, the Japanese or Malayan name of some of the species.)

a. Caudal fin deeply forked, the lobes attenuate. (Ocurus' Gill.)

#### 861. L. melanurus (L.) J. & G.

Olivaceous, with oblique streaks above the lateral line, and some shining golden longitudinal bands on the side; no axillary spot nor lateral blotch; fins chiefly yellow, the caudal not black. Body elongate, compressed; head pointed; lower jaw prominent; upper canines well developed; preopercle without distinct notch; maxillary reaching to front of pupil; eye large, nearly as long as snout,  $3\frac{1}{2}$  in head; top of head with a sharp keel; spines rather slender; pectorals reaching past tips of ventrals; anal spines graduated, short; caudal deeply forked, the inner rays less than half the length of the outer. Head 3; depth 3. D. X, 13; A. III, 9; Lat. l. 51. West Indies, north to Florida.

(Perca melanura L. Syst. Nat. (after Catesby): Sparus chrysurus Bloch, Ichth. taf. 262: Mesoprion chrysurus Cuv. & Val. ii, 459: Mesoprion chrysurus Günther, i, 186: Ocyurus melanurus Goode, Proc. U. S. Nat. Mus. 1879, 114.)

aa. Caudal fin lunate.

 Vomerine teeth forming a cross-shaped or anchor-shaped patch; canines well developed. (Lutjanus.)

### 862. L. caxis (Bloch & Schn.) Poey.—Yelting; Gray Snapper.

Greenish olive, each scale with a brown spot, these sometimes confluent, forming narrow bands extending likewise across the vertical fins; usually a narrow blue stripe on preorbital and checks; young sometimes barred and with the fins dark-edged; no lateral blotch. Snont long and sharp; mouth moderate, maxillary reaching front of pupil; eye large, shorter than snout,  $3\frac{1}{2}$  in head. Checks with about 6 rows of scales; preopercle with a slight notch at the tip of the interopercle; teeth strong; canines in upper jaw well developed; tongue with a sin-

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1862, 236: type Sparus chrysurus Bloch. (ωκὺς, swift; ὁυρὰ, tail.)

gle patch of teeth; nostrils oblong; gill-rakers shortish; spines strong; second anal spine little enlarged. Head 3; depth 23. D. N, 14; A. III, 8; Lat. I. 48. New York to South America; common southward.

(Sparus caxis Bloch & Schneider, 1801, 284; Mesoprion griscus Cuv. & Val. ii, 469; Mesoprion griscus Giiuther, i, 194; Neomanis emarginatus Girard, U. S. Mex. Bound. Surv. Ichth. 18; Poey, Rept. Fis.-Nat. Cuba, 1867, 269.)

### 863. L. blackfordi Goode & Bean.-Red Snapper.

Uniform rose-color; lighter below and on centres of scales; belly silvery; axil of pectoral dark. Body much compressed, lower profile much less arched than the upper. Preopercle finely serrated, the denticulations coarser at the angle; a slight emargination above the angle, in which is received a slight elevation on the interopercular bone. Maxillary reaching the orbit. Lingual teeth in two patches, the anterior cordate; canines strong, two in front of apper jaw larger than others. Anterior nostril round, posterior oblong. Pectorals elongate, reaching past the long ventrals nearly to anal. Third anal spine slenderer and slightly longer than the second. Caudal fin forked, the middle rays two-thirds as long as the external ones. Eye about 7 in head, two-thirds width of preorbital. Head  $2\frac{5}{7}$ ; depth  $2\frac{5}{4}$ . D. X, 14; A. III, 9; L. lat. 50; L. transv.  $\frac{8}{15}$ . Coast of Florida; a large and beautiful species, becoming important as a food-fish.

(Goode & Bean, Proc. U. S. Nat. Mus. i, 176, 1878.)

#### 864. L. stearnsi Goode & Bean.

Scarlet below, shading into reddish or purplish brown above; plum color on sides and top of head; below lateral line the posterior half of the exposed portion of the scales white tinted with scarlet; the basal portion reddish and much darker; lower side of head light scarlet; vertical fins darker than body; pectorals and ventrals white-roseate. Head 3 in length; depth 3. D. X, 14; A. III, 8; L. lat. 45; L. transv.  $\frac{c}{14}$ . (Goode & Bean.) Pensacola, Fla.

(Goode & Bean, Proc. U. S. Nat. Mus. i, 179, 1878.)

bb. Vomerine teeth in a diamond-shaped patch; canines feeble. (Rhomboplites \* Gill.)

865. L. aurorubens (Cuv. & Val.) Vaillant.—Mangrore Snapper; Bastarp Snapper.

Vermilion-red above, rosy below; sides with oblong irregular yellow spots; dorsal and pectoral fins red; ventrals and anal lighter. Body

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1862, 237: type Centropristis aurorubens C. & V. ( $\dot{p}o\mu\betao\varsigma$ , rhomb;  $\delta\pi\lambda\iota\tau\eta\varsigma$ , armed; in allusion to the form of the patch of teeth on the vomer.)

oblong-elliptical, moderately compressed, not elevated. Mouth moderate, without distinct canines. Tongue with a large oval patch of teeth, besides which are 5 or 6 smaller patches. Nostrils round, near together. Preopercle finely serrate, its notch obsolete. Gill-rakers very long and slender. Dorsal spines rather slender; second anal spine a little longer than the third; candal fin lunate, its lobes not attenuate. Head  $3\frac{1}{2}$ ; depth 3. D. XII, 11; A. III, 8; Lat. l. 54. L. 1 foot. West Indies, north to South Carolina and Florida.

(Centropristes aurorubens Cuv. & Val. iii, 45: Mesoprion aurorubeus Giinther, i, 207: Centropristes aurorubens Storer, Mem. Am. Acad. Arts & Sci. 1846, 288: Rhomboplites aurorubens Goode & Bean, Proc. U. S. Nat. Mus. 1879, 136.)

### 283.-POMADASYS Lacépède.

(Pristipoma Cuvier.)

(Lacépède, Hist. Nat. Poiss. iv, 515, 1802: type Seiwna argentea Forsk.)

Body oblong or ovate, somewhat compressed, the back elevated or not; mouth small, terminal, low; the maxillary usually not extending to opposite the eye, its tip not reaching the posterior edge of the broad preorbital; premaxillaries very protractile; teeth on jaws only, in villiform bands, the outer series usually more or less enlarged; a central groove behind the symphysis of the lower jaw; branchiostegals 7; cheeks and opercles scaly; preopercle rather finely and evenly serrate; scales moderate, few, if any, on the dorsal and anal fins; dorsal spines mostly 12, strong; gill-rakers feeble; caudal forked. Species numerous in all warm seas; the range of variation in form is very great in this genus.  $(\pi \tilde{\omega} \mu a, \text{ operculum}; \tilde{\omega} a \sigma \nu z, \text{ rough.})$ 

a. Outer teeth considerably enlarged, eanine.like. (Conodon \* C. & V.)

#### 865. P. nobilis (L.) J. & G.

Body with 8 yellowish brown cross-bands; dorsal spines silvery. Form rather slender; the head conic, somewhat pointed, the lower jaw projecting; month moderate, low, oblique; a series of short, stout canines outside the usual band of villiform teeth; preopercle strongly serrate, with two spinous teeth at the angle, the teeth behind directed upward; chin with a central groove; pectorals narrow, not reaching as far as tips of ventrals, about to vent; second anal spine very long and strong, higher than the soft rays; candal almost truncate. Air-bladder with

<sup>\*</sup> Cuvier & Valenciennes, Hist. Nat. Poiss. v, 156: type Conodon antillanus C. & V. = Sciana plumieri Bloch. (χονος, cone; οδων, tooth.)

two short horns in front. D. XII, 13; A. III, 7; scales 6-54-13. West Indies, north to Texas.

(Perca nobilis L. Syst. Nat.: Sciwna plumieri Bloch, Ichth. vi, 66, taf. 306: Conodon plumieri Günther, i, 304: Conodon antillanus Cuv. & Val. v, 156.)

- aa. Outer teeth moderately enlarged, not canine-like.
  - b. Anal spines graduated. (Orthopristis\* Girard.)

### 867. P. fulvomaculatus (Mitchill) J. & G.—Sailor's Choice; Hog-fish.

Light brown, silvery below; sides with numerous orange-colored and yellow spots; those above the lateral line in oblique series, those below in horizontal rows; vertical fins with similar spots; head blnish, with yellow spots; angle of mouth and gill-membranes with orange. Body oblong, compressed, not much elevated. Head long. Snout conic. Mouth low and small, the maxillary barely reaching to the nostrils. Outer teeth slender and rather short. Eye high,  $4\frac{1}{2}$  in head, nearly midway in its length, its diameter  $\frac{2}{3}$  depth of the broad preorbital. Dorsal and anal entirely naked, with a sheath of scales at base; anterior spines of dorsal higher than the posterior, which are lower than the soft rays; anal spines short, graduated; pectoral moderate, reaching past tips of ventrals; caudal forked, the upper lobe the longer. Head  $3\frac{1}{3}$ ; depth 3. D. XII, 16; A. III, 12; Lat. I. 75; pyloric coca 6. L. 1 foot. Atlantic coast, from New York sonthward; a food-fish of some importance.

(Labrus fulvomaculatus Mitch, Trans. Lit. & Phil. Soc. N. Y. i, 406, 1815: Hæmulon fulvomaculatum DeKay, New York Fauna, Fish. 84: Pristipoma fulvomaculatum Günther, i, 301: Pristipoma fulvomaculatum Holbrook, Ich. S. Car. 157.)

### 868. P. fasciatus (Cuv. & Val.) J. & G.

Sides with irregular dark cross-bars; a dark streak on the upper half of the operculum, extending on the sides; dorsal fin with two or three series of rounded brown spots. Eye 5 in head. Dorsal fin nearly even, its spines rather slender; caudal emarginate; third anal spine thinner and longer than the second. Head 3; depth 3. D. XII, 16; A. III, 13; Lat. l. 75; cœca 6. Gulf of Mexico, north to Louisiana. (Günther.) (Pristipoma fasciatum Cuv. & Val. v, 285: Pristipoma fasciatum Günther, i, 301.)

bb. Second anal spine larger than third. (Pomadasys.)

### 869. P. davidsomi (Steindachner) J. & G.—Sargo.

Grayish silvery, dark above, with many dark points; a very distinct black cross-band on back and sides, from between the fifth and seventh

<sup>\*</sup> Girard, U. S. Mex. Bound. Surv. Iehth. 1859, 15: type Orthopristis duplex Grd. = Labrus fulvomaculatus Mitch. ( $\dot{o}\rho\dot{o}\dot{o}\dot{s}$ , erect;  $\pi\rho\dot{i}\sigma\tau\dot{\epsilon}\dot{s}$ , saw.)

dorsal spines to opposite the lower edge of the pectoral; edge of opercle and base of pectoral black; fins otherwise dull yellowish. Body ovate, compressed, much elevated; a regular and steep curve from snout to dorsal. Mouth small, terminal; maxillary not reaching front of eye. Preorbital about as wide as eye, which is 4 in head. Outer teeth distant, little enlarged. Gill-rakers moderate. Membranes of dorsal and anal somewhat scaly; dorsal fin deeply emarginate; second anal spine longer and stronger than third; pectoral long, reaching vent; candal forked, the upper lobe the longer. Head  $3\frac{2}{5}$ ; depth  $2\frac{1}{2}$ . D. XII, 14; A. III, 10; scales 10-56-22. L. 12 inches. Pacific coast, from Santa Barbara Islands southward.

(Pristipoma davidsoni Steindachner, Ichthyol, Beiträge, iii, 6, 1875.)

### 870. P. virginieus (Linn.) J. & G.

Golden olive above, silvery below, a dusky oblique bar running from nape forward through eye, and another running vertically downwards from beginning of dorsal; behind this are several narrow longitudinal stripes of bright light blue edged above and below with black. Body ovoid, compressed, and much elevated. Profile very steep. Mouth small, oblique; maxillary searcely reaching front of orbit; onter teeth rather strong. Eyes rather large. Second anal spine very strong, longer than soft rays; pectoral long, reaching anal. Head 3½; depth 2½. D. XII, 17; A. III, 9. South Atlantic coast of United States to Lower California.

(Sparus virginicus Linn. Syst. Nat.: Pristipoma virginicum Günther, i, 288: Anisotremus virginicus Gill, Proc. Acad. Nat. Sci. Phila. 1861, 106: Anisotremus taniatus Gill, Proc. Acad. Nat. Sci. Phila. 1861, 107.)

### 871. P. bilimentus (C. & V.) J. & G.

Body rather deep; snout obtuse, shorter than eye, which is one-third length of head; mouth narrow, the maxillary reaching front of eye; preopercle serrulate, the teeth at the angle stronger; dorsal spines strong, the third spine longest, half length of head; second anal spine extremely strong, much longer than dorsal spines; vertical fins scaly half their height; caudal emarginate. Two parallel brown bands on each side, one above the lateral line, the other from the eye to a brown spot at the root of the caudal; adults becoming uniform in color; fins blackish. Head  $3\frac{3}{3}$  (in total, with caudal); depth  $2\frac{3}{3}$ . D. XII, 17; A. III, 8; scales 9–50–14. (Günther.) Tropical America, on both coasts, north to San Diego.

(Privitipoma bilineatum and melanopterum Cuv. & Val. v, 271, 273; Privitipoma melanopterum Günther, i, 287: Privitipoma melanopterum Steind. Ichth. Beitr. viii, 5, 1879.)

### 284 .- DIABASIS Desmarest.

Red Months

(Hamulon Cuvier.)

(Desmarest, Première Decade Ichth. (1818): type Diabasis parræ Desm.)

Body oblong, usually more or less elevated; mouth wide, the maxillary very long, reaching usually to below the eye, its tip extending to the posterior end of the preorbital; no teeth on vomer or palatines; teeth of the jaws conical, the outer series stronger, curved; lips and inside of the mouth commonly bright red in life; soft parts of the vertical fins completely covered with scales; a marked angle formed at the junction of the spinous and soft parts of the dorsal; second anal spine enlarged, generally larger and longer than the third; caudal forked. Species very numerous. (διάβασις, a crossing; the allusion not evident.)

\* Sides of the head with blue stripes.

### 872. D. formosus (L.) J. & G.-Black Grunts.

Brownish above, sides lighter; top and sides of head with very many (12 or more) narrow wavy longitudinal lines of dark blue, which do not extend on the trunk; 6 or more of them on preorbital; fins dusky, with a more or less apparent bluish tint; a red blotch at angle of month, extending forward on lower lip. Body oblong, compressed and clevated, highest at origin of dorsal fin; profile very convex to front of eye, where the long, compressed snout forms an angle with it. Eye posterior and high up; 2 in snout, 4 in head. Month large; maxillary reaching front of orbit. Snout with a few scattered scales. Second anal spine much enlarged. Head  $2\frac{3}{4}$ ; depth  $2\frac{3}{3}$ . D. XII, 17; A. III, 9; Lat. l. 55. South Atlantic coast of the United States and southward.

(Perca formosa Linn, Syst. Nat,: Hamulon formosum Giinther i, 305: Hamulon arcuatum Cuv. & Val. ix, 481: Hamulon arcuatum Holbrook, Ich. S. C. 4860, 124.)

### 873. D. chrysopterus (Linn.) J. & G.

Light brown above; sides brilliantly silvery; mouth red posteriorly, white in front. Body with general form of preceding, but the back less elevated, the profile being nearly straight. Scales of the pectoral region not larger than the others. Head  $2_4^3$ ; depth  $2_4^3$ . D. XIII, 14; A. III, 10; Lat. l. about 55. (Holbrook.) West Indies, north to South Carolina.

(Perca chrysoptera Linn. Syst. Nat.: Hamulon chrysopterum Günther, i, 313: Hamulon chrysopterum Holbrook, Ich. S. C. 1860, 121.)

aa. Body striped or banded.

<sup>\*\*</sup> Sides of head without blue stripes.

a. Body not striped.

### 874. D. fremebundus (Goode & Bean) J. & G.

Pale, with a pair of bands as broad as the pupil extending from the snout, where they unite, following the dorsal line at a distance about equal to their own width, and connecting with the same at the end of the base of the second dorsal, where they reunite; a second broad pair of bands extending from the snout through the middle of the eye, in a straight line below the lateral line to the base of the caudal; traces on the head of a pair of narrower bands between the two other pairs; a single stripe on the mesial line of the body, from a point in advance of the eyes to the region of the dorsal; a very prominent blotch at base of eaudal fin; maxillary extending beyond front of orbit; dorsal fin moderately notched, the fourth spine the longest; second anal spine very strong and longer than the fourth dorsal spine, also longer than the third anal spine; scales very large, irregularly arranged. Head 3; D. XI, I, 15; A. III, 8; L. lat. 50; L. transv. 5. (Goode d. Bean.) Clear Water Harbor, Florida.

(Hamulon fremebundum Goode & Bean, Proc. U. S. Nat. Mus. ii, 340, 1879.)

### 875. D. trivittatus (Bloch & Schn.) J. & G .- White Grunt.

Greenish olive, sides with about 4 distinct brownish or yellowish longitudinal streaks running up on sides of head; the two middle ones broader and golden, running from the eye and muzzle below the lateral line; lips and mouth brilliant red; dorsal and caudal fins grayish brown. Body rather elongate, fusiform, compressed and but little elevated; snout sharp; mouth moderate, somewhat oblique, the narrow maxillary reaching beyond front of orbit; eye as long as snout; second and third anal spines of nearly equal length, the second the stronger. Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ . D. XIII, 14; A. III, 8; Lat. 1. 70. South Atlantic coast of United States and southward; well distinguished from the other American species by its slender form.

(Grammistes trivittatus Bloch & Schneider, 1801, 188; Serranus capeuna Licht, Berl. Abhandl. 1820, 288; Hamulon quadrilineatum Günther, i, 316; Hamylum capeuna Goode, Bull. U. S. Nat. Mus. v, 53.)

#### 285.-LOBOTES Cuvier.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type Lobotes erate Cuvier = Holocentrus surinamensis Bloch.)

Body oblong, compressed and elevated, covered with moderate-sized, weakly ctenoid scales; profile of head concave, the snout prominent; mouth moderate, oblique, with thick lips; upper jaw very protractile, the lower the longer; jaws with narrow bands of villiform teeth, in

front of which is a row of larger conical teeth directed backward; no teeth on vomer or palatines; preorbital narrower than eye; preopercle strongly serrate. Branchiostegals 6. Dorsal fin continuous, with 12 spines which may be depressed in a shallow groove; soft rays of dorsal and anal fins elevated; anal spines graduated; bases of soft dorsal and anal thickened and scaly; candal rounded. Air-bladder present. Pyloric cœca 3; vertebre 13 + 11. ( $\lambda \circ \beta \circ \tau \circ \tau$ , lobed; the soft parts of dorsal, anal, and caudal said to resemble one three-lobed fin.)

### 876. L. surimamensis (Bloch) Cuvier.—Flasher.

Blackish above, becoming silvery-gray on the sides; often blotched and tinged with yellow; fins dusky gray, sometimes with yellow. Head small. Profile from dorsal to occiput strongly convex, from occiput to snout concave; maxillary reaching beyond middle of orbit. Scales around eye very small, those on opercle large. Eye small, much shorter than snout. Pectorals shorter than ventrals, which do not reach vent; soft dorsal higher than the spinous portion. Head 3; depth 2½. D. XII, 16; A. III, 11; L. lat. 47. A large fish, reaching a length of from 2 to 3 feet, and found in all warm seas; north on our coast to Cape Cod.

(Holocentrus surinamensis Bloch & Schneider, 1801, 316: Lobotes auctorum Günther, i, 338; Holbrook, Ich. S. C. 1860, 169.)

## 286 .- SPARUS Linnaus.

(Pagellus, Chrysophrys and Pagrus Cuvier; Calamus Swainson.)
(Linnæus, Syst. Nat.: type Spurus auratus L.)

Body oblong or ovate, compressed, covered with moderate-sized scales. Head moderate. Opercles not armed. Cheeks scaly. Month rather small, terminal, low. Anterior teeth in the jaws eardiform, the outer series of teeth generally enlarged, sometimes canine-like, not compressed. Both jaws with two or more series of rounded molar teeth, which are sometimes irregularly mixed with slender teeth; no teeth on vomer or palatines. Dorsal rather low, the spines, 11–13 in number, depressible in a groove; anal spines moderate, the second not greatly developed. Caudal fin forked. Air-bladder simple. Gill-rakers short. Branchiostegals 6. Intestinal canal short. Pyloric cœca few. Carnivorous fishes, mostly of the Atlantic.  $(\sigma\pi\delta\rho\sigma_5, Sparus, the ancient name; from <math>\sigma\pi\iota\iota(\rho\sigma)$ , to struggle.)

a. Anterior teeth not canine-like. (Pagellus\* C. & V.)

<sup>\*</sup>Cuvier & Valenciennes, Hist. Nat. Poiss. vi, 169, 1830: type Sparus crythrinus L. (From pagel, a French name of Sparus crythrinus.)

### 877. S. milmeri (Goode & Bean) J. & G.

Dull silvery with brown cross-bands. Form of *Diplodus argyrops*. Diameter of eye equalling length of opercle; eye about 4 in head, less than  $1\frac{1}{2}$  in snont. Preorbital nearly as high as long, with the edge nearly straight. Five series of scales between the preorbital and angle of preopercle. Three series of molars in the upper jaw, two in the lower; front teeth not described. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{4}$ . D. XII, 12; A. III, 10; L. lat. 48; L. transv.  $\frac{7}{14}$ . (Goode & Bean.) Charlotte Harbor, Fla.

(Pagellus milneri Goode & Bean, Proc. U. S. Nat. Mus. ii, 134, 1879.)

aa. Auterior teeth canine-like.

b. Molar teeth above in two series. (Pagrus\* Cuvier.)

### 878. S. pagrus L.

Silvery; back rose-colored. Upper profile of the head parabolic; an obtuse prominence before the upper anterior angle of the eye; preorbital a third higher than long, with an incision in front. No procumbent dorsal spine. Dorsal spines not elongate; second anal spine stronger but not longer than the third, one-fourth the length of the head; pectoral elongate, reaching the fourth soft ray of the anal. Eye  $1\frac{1}{3}$  in interorbital space;  $1\frac{2}{3}$  in snont. Head 3; depth  $2\frac{2}{3}$ . D. XII, 10; A. III, 8; scales 6–56–16. Mediterranean Sea and neighboring waters; occasional on our South Atlantic and Gulf coasts.

(L. Syst. Na<sup>†</sup>.: Sparus argenteus Bloch & Schneider, 1801, 271: Pagrus vulgaris Günther, i, 463: Pagrus argenteus Goode & Bean, Proc. U. S. Nat. Mus. 1879, 133.)

### 879. S. chrysops L.-Porgee.

Color nearly plain dull silvery; axil dusky; ventrals dark. Back elevated; head large and heavy; eye large, placed high; preorbital very large, its diameter half greater than that of eye; interorbital area very convex. Six strong conical teeth in front of upper jaw, and 8 in lower; about 2 rows of molars, the inner series larger. Five rows of scales on the widest part of the cheek, 4 on the interopercle; breast seales large. A procumbent spine before the dorsal; dorsal spines rather high; second and third anal spines about equal; candal forked; pectoral long and falcate, reaching the last anal spine; ventrals moderate. Head 3; depth 2½. D. XIII, 12; A. III, 11; Lat. l. 52. South Atlantic coast; abundant; long overlooked by naturalists, lately rediscovered by Mr. R. E. Earll.

(Sparus chrysops L. Syst. Nat.; Goode MSS.)

<sup>\*</sup>Cuvier, Règne Anim. ed. 2, 1817: type Sparus pagrus L.  $(\pi \acute{\alpha} \gamma \rho o \acute{s},$  the ancient name of the typical species.)

### 880. S. neulentus (C. & V.) Gill.

Silvery; reddish on the sides, with golden longitudinal streaks; dorsal and anal fins reddish, ventrals red. Pectoral clongate. Limb of preopercle scaly. Molar teeth small, in two\* series in the upper jaw. Body rather clongate. A procumbent spine before the dorsal. D. XII, 12; A. III, 12. (*Curier & Valenciennes.*) Atlantic coast of the United States, chiefly southward; rare; a doubtful species, perhaps the same as the preceding or the next.

(Chrysophrys aculeata Cuv. & Val. vi, 137: Chrysophrys aculeatus Giinther, i, 495.)

# 287.—DIPLODUS Rafinesque.

(Sargus Cuvier, 1817; preoccupied in Entomology.)

(†Rafinesque, Indice Ittiologia Siciliana, 1810, 54: type Sparus annularis L.)

Body oblong or ovate, more or less compressed, the back often elevated. Month rather small, terminal, low. Incisors broad or narrow, truncate, entire or more or less emarginate, sometimes serrate in the young; a series of smaller teeth behind them. Molar teeth mostly in 2 or 3 rows. No teeth on vomer or palatines. Scales moderate. Dorsal spines mostly 12, strong, depressible in a groove. Procumbent dorsal spine present or absent; anal spines rather strong. Candal fin forked. Gill-rakers short and slender. Branchiostegals 6. Intestinal canal short. Pyloric coca few. Carnivorons species; abundant in the Atlantic, many of them highly valued as food. (διπλόνε, double; δονός, tooth; the teeth of two sorts.)

a. Incisor teeth very narrow, entire. (Stenotomust Gill.)

### 881. D. argyrops (L.) J. & G.—Seup; Scuppaug; Porgee.

Brownish, somewhat silvery below, everywhere with bright reflections, but without distinct markings in the adult; soft parts of vertical fins somewhat mottled with dark; young faintly barred; axil dusky. Body ovate, compressed, the back elevated, the axis of the body near the middle of its depth. Head deep. Eye narrower than the preorbital. Mouth small, terminal, the maxillary extending to opposite the posterior nostrils. Incisor teeth very narrow, almost con-

<sup>\*</sup> In three series according to C. & V. The original type is now lost, but a memorandum by Aug. Duméril, preserved in the Museum at Paris, states that the specimen was a "Pagras" (with two rows of molars), and not a "Chrysophrys" (with three).

<sup>† &</sup>quot;VI. Gen. Diplodus. Una sola ala dorsale principando vicino al capo, un apendico squamosa vicino ad ogni ala toracina. Osserr. Contiene il Sparus annularis di Linneo, ed Sp. rariegatus di Lacépède." (Rafinesque.)

<sup>‡</sup>Gill, Canadian Naturalist, August, 1865: type Sparus argyrops L. (στενός, narrow; τομος, cutting.)

ical; molars in two rows above. Cheeks short and deep with 4 rows of scales. A procumbent spine in front of the dorsal. Third dorsal spine elevated, often somewhat filamentous. Pectorals moderate, reaching front of anal, ventrals a little further; second anal spine a little the longest. Head 3¼; depth 2. D. XII, 12; A. III, 11. Scales 8-49-16; L. 12 inches. Cape Cod to Florida; abundant; a valuable food-fish.

(Sparns argyrops L. Syst. Nat.: Pagrus argyrops Cnv. & Val. vi, 164: Pagrus argyrops Holbrook, Ich. S. Car. 174: Pagrus argyrops Günther, i, 472: Sargus ambassis Günther, i, 449: Stenotomus argyrops Gill, and of most late American writers.)

aa. Incisor teeth broad.

b. In eisor teeth emarginate; procumbent dorsal spine present.  $(Lagodon^*\ {\bf Holbrook.})$ 

### 882. D. rhomboides (L.) J. & G.—Pin-fish; Bream.

Brownish, white below; sides of head and body with horizontal stripes of light blue and golden; 6 or 7 very faint darker vertical bands, disappearing with age; vertical fins yellowish, with bluish stripes; a dark axillary spot. Body ovate, elliptical, compressed, and somewhat elevated, the axis of the body near the middle of its depth; snont about in the axis. Head rather sharp. Mouth small, the upper jaw more freely protractile than usual. Molars in two series; anterior incisors each deeply notched. Checks with 5 or 6 rows of scales; scales on breast little reduced in size. A procumbent spine before the dorsal fin; dorsal spines high, much higher than the soft rays, the fourth highest; second anal spine little larger or longer than the third; pectorals as long as head; ventrals moderate. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{3}$ . D. XII, 11; A. III, 11; scales 8-66-18. L. 1- inches. New Jersey to Texas; abundant southward.

(Sparus rhomboides Linn. Syst. Nat.: Sargus rhomboides Cuv. & Val. vi, 68: Sargus rhomboides Günther, i, 447: Lagodon rhomboides Holbrook, Ich. S. Car. 1860, 59.)

aa. Incisors entire in the adult; emarginate or serrate in the young.

b. A procumbent spine before the dorsal fin. (Archosargus† Gill.)

### 883. D. probatocephalus (Walb.) J. & G.-Sheepshead.

Grayish, with about 8 vertical black bands, which are about as broad as the interspaces; dorsal dusky; ventral and anal black; base of pectoral dusky. Body robust, becoming very deep with age, the back compressed and elevated; axis of the body below the middle of the depth; snout entirely below axis of body; profile very steep;

<sup>\*</sup> Holbrook, Ich. S. Car. ed. i, 56, 1859: type Sparus rhomboides L.  $(\lambda \alpha y \omega s$ , hare;  $\omega \delta \omega v$ , tooth.)

<sup>+</sup>Gill, Canadian Naturalist, August, 1865: type Sparus probatocephalus Walb. ( $\ddot{\alpha}\rho\chi ov$ , ruler;  $\sigma \dot{\alpha}\rho\chi o\varsigma$ , Sargus, from its preëminence in size and value.)

preorbital broad. Month low, horizontal; incisors broad, serrated in the young, then becoming emarginate and finally entire. Cheeks with 6 rows of scales; scales on breast very small, crowded. Dorsal spines very strong, higher than the soft rays, the last considerably shortened, so that the outline of the fin is emarginate; second anal spine very strong, nearly as long as the snout and eye; pectoral very long, reaching past the front of the anal; ventrals reaching vent. Head 34; depth 13. D. XII, 12; A. III, 10; scales 7-45-16. L. 30 inches. Cape Cod to Texas; abundant; the largest member of the genus, and one of our most valued food-fishes.

(Sparus probatocephalus Walbaum, Artedi, Pisc. 1792, 295; Sargus oris Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 392, 1814; Sargus oris Cuv. & Val. vi, 53; Sargus oris Holbrook, Ich. S. Car. 1860, 54; Günther, i, 447; Archosargus probatocephalus Gill, and of most late American writers.)

bb. No procumbent spine before the dorsal fin. (Diplodus.)

### 881. D. holbrooki (Bean) J. & G.-Bream.

Dull silvery, without cross-bands; dorsal, caudal, anal, ventrals, axil, and edge of opercle dusky; a black blotch on caudal peduncle above. Body ovate, not elevated, compressed, the axis of the body below the middle of its depth. Eight incisors in each jaw; three rows of molars above, two below. Pectoral 3 in length; second anal spine longest. Head  $3\frac{1}{5}$ ; depth  $2\frac{1}{2}$ . D. XII, 14; A. III, 13; scales 8–61–16. L. 12 inches. Charleston, S. C. (Bean.) (Possibly the adult form of the next.)

(Sargus holbrooki Bean, Forest and Stream, June 13, 1878, and in Proc. U. S. Nat. Mns. 1878, 198.)

### 885. D. Canadianaculia (Pecy) J. & G.—Spot-tailed Pin-fish.

Silvery, with bright reflections; about 8 very narrow dark vertical bands; a very distinct black bar on back and sides of caudal peduncie; shining streaks and dark punctulations along the rows of scales; ventrals and anal mottled with dusky; edge of opercle dusky; axil dark. Body ovate, compressed, very deep. Dorsal and ventral outlines both strongly arched, the axis of the body at about the middle of the depth, the back steeply elevated behind the nape. Maxillary not reaching the eye, which is 3 in head. Caudal peduncle short and slender, about as deep as long. Cheeks with 3 rows of scales; interopercle broad, with 3 distinct rows of scales; scales on breast not much reduced. Mouth very small, terminal. Incisors broad, entire. Spines moderate, those of the dorsal higher than the soft rays; second anal spine longest; pectorals long, reaching to anal; ventrals reaching to vent. Head 3\frac{3}{3};

depth 2. D. XII, 14; A. III, 13; scales 6-63-14. L. 5 inches. North Carolina to Cuba; abundant at Beaufort, N. C.

(Sargus caudimacula Poey, Memorias, ii, 198, 1858: Sargus holbrooki Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 379; not of Bean.)

### 288.-GIRELLA Gray.

(Camarina Avres.)

(Gray, Illustr. Ind. Zoöl. 1838: type Girella punctata Gray.)

Body oblong-ovate, compressed, covered with rather large scales. Mouth small, with a series of flat, trienspid, movable incisors, behind which is a broad band of similar smaller ones; no molar teeth; no teeth on vomer or tongue. Cheeks with very small scales; opercles and top of head chiefly naked. Dorsal fin rather low, with about 14 spines, on the bases of which the scales extend, forming an imperfect sheath; no groove at base of dorsal; no procumbent dorsal spine; anal spines small, graduated; caudal lunate. Air-bladder divided into two posterior horns. Pyloric ecca numerous; intestinal canal elongate; peritoneum black. Herbivorous. Pacific Ocean. (A latinization of the French "Girelle"=Julis.)

# 886. G. migricums (Ayres) Gill.—Blue-fish.

Dusky green, paler below; young with a large yellowish spot on each side of the dorsal fin. Body oval, compressed, with very deep candal peduncle; snout thick, its profile evenly rounded; mouth small, subinferior, low, nearly horizontal; maxillary reaching nearly to front of orbit; a minute patch of palatine teeth; preopercle minutely serrulate at its angle; preorbital as broad as eye. Gill-rakers numerous, rather long. Scales firm, weakly etenoid, those on thorax and front of back smaller. Dorsal spines lower than the soft rays; anal higher than soft dorsal, similar to it; candal emarginate; pectorals short and broad, not reaching vent; ventrals short. Head 4; depth 2½. D. XIV, 14; A. III, 12; Lat. l. 50. L. 12 inches. Coast of California, from Monterey sonthward, abundant in rocky places, feeding on sea-weed.

(Camarina nigricans Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 81: Girella dorsomacula Gill, Proc. Acad. Nat. Sci. Phila. 1862, 244.)

### 289.—PIMELEPTERUS Lacépède.

(Lacépède, Hist. Nat. Poiss. iv, 429, 1802: type Pimelepterus bosci, Lacépède.)

Body regularly ovate, moderately compressed; head short, with blunt snout; eye large; mouth small, horizontal; maxillary barely reaching front of eye; both jaws with a single series of rather narrow

obtusely lanceolate incisors, implanted with compressed usually conspicnous roots posteriorly; behind these a narrow band of villiform teeth; fine teeth on yomer, palatines, and tongue. Branchiostegals 7; gill-rakers long. Preopercle obsoletely serrate; preorbital narrow, covering but little of the maxillary. Squamation very complete, the space between and about the eyes being the only naked part; scales smallish, thick, ctenoid, 60-70 in the lateral line, which is continuous; similar scales entirely covering the soft parts of the vertical fins, and extending up on the paired fins. Dorsal fin low, with about 11 spines, which are depressible in a groove of scales; the fin continuous, but the last spines low, so that a depression occurs between the two parts of the fin; the bases of the spinous and soft parts about equal; anal similar to soft dorsal, with 3 spines; caudal fin forked; pectoral fins small; ventrals well behind them. Intestinal canal long. Pyloric coca usually very numerous. Species numerous, in all warm seas. Herbivorous. (πιμελής, fat: πτερόν, fin.)

a. Soft dorsal and anal not elevated, the latter rather short. (Pimelepterus.)

### 887. P. bosci Lac.

Dusky, with series of light stripes, about 25 in number, following the rows of scales; the middle part of each scale pale, the edge dusky; the stripes along middle of body much broader than the others, the scales along the back and belly being much smaller; a silvery streak along the preorbital. Body ovate, somewhat compressed. Longest dorsal spine one-fifth the height of the body, rather higher than the soft dorsal and nearly equal to the longest ray of the anal. Horizontal process of the teeth not much longer than the vertical. Interorbital space 2½ in head; top and sides of head finely scaled; interorbital region gibbous, below which point the snont is truncate; preopercle weakly serrulate; gill-rakers long. Soft dorsal and anal very low; median dorsal spines highest; second anal spine highest; caudal well forked, the lower lobe longest. Head 4½; depth 2½. D. XII, 12; A. III, 11; scales 10–66–20; vertebræ 9 + 16. Massachusetts to Panama; common southward.

Bull. Nat. Mus. No. 16-36

<sup>(?</sup> Perca sectatrix L. Syst. Nat.: Pimelepterus bosei Lacépède, Hist. Nat. Poiss. iv, 429, 1802; P. bosei Cuv. & Val. vii, 258; P. bosei Günther, i, 497; Pimelepterus flavolineatus Poey, Repert. i, 319; Poey, Synopsis Pisc. Cubens. 324, 1868.)

### 290 .- SCORPIS Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. viii, 503, 1831: type Scorpis georgianus Cuv. & Val.)

Body ovate or suborbicular, covered with small, firm, ctenoid scales, which also cover the membranes of the soft parts of the vertical fins; mouth small, terminal, horizontal; the maxillary narrow, slipping under the edge of the rather narrow preorbital; sides, top of head and jaws closely scaled: preopercle entire or minutely crenulate: jaws with broad bands of slender teeth; those in the outer series incisor-like.\* compressed, narrow and lanceolate in form, the outer surface transversely convex, the inner concave; the other teeth of the jaws are similar, but grow progressively smaller backward toward the inside of the mouth: incisors without conspicuous roots behind; all the teeth are somewhat movable, as in Girella: no molar teeth: vomer, palatines, and tougue with patches of minute villiform teeth; gill-rakers slender, rather long: dorsal spines low, in a slight groove, about 10 in number; soft part of the fin elongate, much longer than the spinous part, sometimes falcate: anal spines small, graduated, the soft rays numerous; caudal lunate; scales thinnish, adherent, with smaller ones intermixed; pyloric cœca extremely numerous; air-bladder small; branchiostegals 7. (σχορπίς, name of some sea-fish; from σχορπίος, scorpion.)

a. Body ovate; fins not falcate. (Casiosoma Kaup †)

### 888. S. californiensis Steindachner.-Medialuna.

Blackish above, tinged with bluish; steel-blue or grayish below, somewhat mottled; sides with faint oblique vertical lines of spots; fins blackish. Body elliptic-ovate, its outlines regular; head bluntish, rounded, strongly convex; maxillary not reaching front of eye; eye small,  $1\frac{1}{3}$  in snout, 5 in head; middle spines of dorsal highest, their height searcely greater than the diameter of the eye; soft dorsal low, not elevated in front, little higher than the spines; anal low; caudal lunate, the upper lobe slightly longer; pectorals short and narrow; ventrals rather small. Head  $3\frac{2}{3}$ ; depth  $2\frac{1}{4}$ . D. IX, I, 22; A. III, 19; scales 9-58-19. L. 12 inches. Coast of California, from Point Concepcion southward; a hand-some fish, of considerable value as food.

"(Steindachner, Iehthyol. Beiträge, iii, 19, 1875.)

<sup>\*\*.</sup>In Scorpis georgianus, the type of the genus, the onter teeth are said to be conic. This is probably erroneous, otherwise our species does not belong to the genus.

tKaup; Bleeker, Systema Percarum ii, 11, 1875: type Scorpis aquipiunis Rich.

# FAMILY LXXXIX —APOGONIDÆ.

Body oblong, elevated, covered with usually large, loose, deciduous scales, which are striated and etenoid or sometimes cycloid; cheeks scaly; lateral line continuous; cleft of month wide, oblique; villiform teeth on jaws and vomer; canines sometimes present; preopercle commonly with a double ridge, its edge entire or slightly serrated; lower pharyngeals separate, with sharp teeth; pseudobranchiæ present; branchiostegals 6 or 7. Dorsal fins well separated, the first with 6 or 7 rather strong spines; anal fin short, usually with 2 spines; ventral fins thoracic, I, 5. Fishes mostly of the Eastern seas, some of them in fresh waters. Genera about 10; species about 120.

(Percida part: group Apogonina Günther, i, 222-250.)

- a. Branchiostegals 7; no canines; no recumbent dorsal spine; palatine teeth present; anal spines 2. (Apogoniuw.)

### 291.—APOGON Lacépède.

# King of the Mullets.

(Amia Gronow, not of Linneus.)

(Lacépède, Hist. Nat. Poiss. iii, 411, 1802: type Apogon ruber Lac. = Mullus imberbis L. = Apogon rex-mullorum C. & V.)

Body oblong, compressed, covered with very large ctenoid scales. Lateral line continuous. Head large; mouth wide, oblique, the maxillary extending to below the middle of the large eye; villiform teeth on jaws, vomer, and palatines; no canine teeth; preoperele with a double ridge, entire or somewhat serrate; operele with a spine behind. Gill-rakers rather long. Dorsal spines 6 or 7, strong; second dorsal remote, short; anal with 2 spines, the second much the longer, the soft part similar to the soft dorsal; pectorals and ventrals moderate.  $(a\pi \dot{\omega} \gamma \omega_r)$ , without beard; thus distinguished from the bearded mullet, Mullus.)

a. Edges of preoperele serrulate; scales very large. (Apogon.)

#### 889. A. americanus Castelnau.

Violaceous, scales all with dark points; a dark spot on opercle. Body comparatively elongate, little elevated; jaws equal; muzzle short; eye large,  $3\frac{1}{5}$  in head; preopercle very finely denticulated. Second dorsal spine stoutest, as high as the third; pectorals nearly reaching anal.

Depth 3 in total. Head  $3\frac{1}{2}$ . D. VI-I, 9; A. II, 8; scales 3-25-9. (Vaillant & Bocourt.) West Indies; accidental at Newport.

(Castelnau, Anim. Nouv. Rares Amér. du Sud, Poiss. 3; Vaillant & Bocourt, Miss. Sci. au Mex. 41: Apogouichthys americanus Günther, i, 247.)

aa. Edge of preopercle entire; scales comparatively small. (Glossamia\* Gill.)

### 890. A. pandionis Goode & Bean.

Color nearly plain reddish, the body and fins everywhere speckled with fine dots. Body oblong, not elevated nor greatly compressed. Eye very large, forming nearly half the length of the side of the head, much greater than the interorbital space; maxillary extending to opposite pupil; preopercle entire. Gill-rakers very long and slender. Mouth oblique, but not nearly vertical, the lower jaw projecting. Fins low; caudal well forked. Head 4; depth 4. D. VII-I, 9; A. II, 9; scales small, cycloid, 3-45-8. Deep water, off Chesapeake Bay.

(Goode & Bean, Proc. U. S. Nat. Mus. 1881, 160.)

# FAMILY XC.—MULLIDÆ

(The Surmullets.)

Body elongate, slightly compressed, covered with large etenoid scales; lateral line continuous; large scales on the head; upper profile of the head more or less parabolic. Mouth small; teeth present in one jaw at least, and sometimes in both, or on the vomer or palatines. Premaxillaries protractile; maxillaries without supplemental bone, partly hidden by the broad preorbital. Eye moderate, placed high; branchiostegals 4; 2 long barbels at the throat, attached just behind the symphysis of the lower jaw. Dorsal fins 2, remote from each other, the first of several high spines, which are depressible in a groove; anal similar to the soft dorsal, with 1 or 2 small spines; ventials thoracic, I, 5. Genera 5; species 35, in all tropical seas, some species straying northward.

(Mullidæ Günther, i, 397-411.)

#### 292.-MULLUS Linnæus.

#### Surmullets.

(Linnæns, Syst. Naturæ: type Mullus barbatus L.)

Teeth in the lower jaw and on the vomer and palatines; none in the upper jaw; dorsal spines 7; anal spines very small. Otherwise as in

 $<sup>^{\</sup>star}$  Teeth in lower jaw, and on vomer and palatines; none in the upper jaw. Mullus, 292.

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1863, 82: type Apogon aprion Rich. (γλώσσα, tongue; αμια, Amia, a name applied by Gronow to Apogon.)

Upencus, the head rather shorter. One species known. (Latin, mullus, the ancient name of Mullus barbatus, from  $\mu \dot{\phi} \lambda \lambda \sigma \varsigma$ , lip; hence "mullet," a fish with thick lips.)

### 891. M. barbatus L.—Surmullet.

Red, with three yellow longitudinal stripes. Body oblong, moderately compressed; snout blunt, its profile very obliquely decurved; mouth horizontal, small; maxillary scarcely reaching front of orbit; diamter of eyes about equalling the slightly concave interorbital space. Head 3½; depth 3¾. D. VII-I, 9; A. II, 6; Lat. l. 36, its mucous tubes branching into a network on each scale. European; this or some similar species said to have been once taken at New York (Gill). One of the choicest food-fishes of the Mediterranean.

(Linn. Syst. Nat.: Mullus barbatus and surmuletus Günther, i, 401: Mullus, sp. incog. Gill, Rept. U. S. Fish Com. 1872-3, 804.)

#### 293 .- UPENEUS Cuvier.

### Goat Fishes.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type Mullus barberiuus Lac.)

Body oblong, compressed; mouth moderate, nearly horizontal, low, the jaws subequal; eye large, high, posterior; opercle short, deep, with a posterior spine; jaws with rather strong teeth, in one series, or in a narrow band; no teeth on vomer or palatines; lips well developed; barbels nearly as long as head; scales very large, somewhat etenoid; lateral line continuous, its tubes ramifying on each scale; head covered with large scales; first dorsal with about 7 spines; anal with 2, the first very short; caudal fin forked. Species numerous in the tropical seas. (An old name of some fish; from  $\Im \pi / \nu \eta$ , upper lip.)

a. Teeth in the upper jaw in more than one series. (Pseudupeneus\* Blecker.)

### 892. U. maculatus (Bloch) Cav. & Val. -Goat Fish.

Red; sides of head with bluish longitudinal lines; three black blotches along the lateral line; each scale with a blue spot at its base; body oblong, moderately compressed, tapering backwards from occiput; ventral outline nearly straight; snout long and rather sharp; mouth terminal, small; maxillary not reaching orbit; eyes situated backwards and high up; head 3\frac{1}{4}; depth 4. D. VII-I, 8; A. II, 6; Lat. I. 30, high up and following the curve of the back. V. 10 + 14. West Indies; occasional on our coast.

(Mullus maculatus Bloch, Ichthyol, 1797, taf. 348; Giinther, i, 408; Mullhypeneus maculatus Poey, Synopsis, 1868, 307: Hypeneus maculatus Goode, Bull. U. S. Nat. Mus. v, 49.)

<sup>\*</sup>Pseudupeneus Bleeker, Poiss. Côte Guinée, 1862, 56: type Upeneus prayensis Cuv. & Val. (ψεῦδος, false; Upeneus)=Mullhypeneus Poey, 1868.

# FAMILY XCL—SCLÆNIDÆ.

(The Croakers.)

Body compressed, more or less elongate, covered with rather thin. etenoid scales. Lateral line continuous, extending on the candal fin. Head prominent, covered with scales. Bones of the skull cavernous, the muciferous system highly developed, the surface of the skull, when the flesh is removed, very uneven. Chin usually with pores, sometimes Month small or large, the teeth in one or more series, the outer of which are sometimes enlarged; canines often present. No incisor nor molar teeth; no teeth on vomer, palatines, ptervgoids, nor tongue. Maxillary without supplemental bone, slipping under the free edge of the preorbital. Premaxillaries protractile, but not very freely Nostrils double. Pseudobranchiæ usually large, present in all our genera. Gills 4, a slit behind the fourth. Gill-rakers present. Branchiostegals 7. Gill-membranes separate, free from the isthmus. Lower pharyngeals separate or united. Preopercle serrate or not. Operele usually ending in two flat points. Dorsal fin deeply notched, or divided into two fins, the soft dorsal being the longer, the spines depressible into a more or less perfect groove. Anal fin with 1 or 2 spines. Ventral fins theracie, I, 5. Pectoral fins normal. Caudal fin usually not forked. Ear-bones very large. Pyloric ecca usually rather few. Air-bladder usually large and complicated (wanting in Menticirrus). Most of the species make a peculiar noise, called variously eroaking, grunting, drumming, and snoring. This sound is supposed to be caused by forcing the air from the air-bladder into one of the lateral horns. Carnivorous. An important family of about 25 genera and 125 species, found in all warm seas, one species being confined to fresh Many of them reach a large size, and nearly all are valued for food.

(Scianida Günther, ii, 265-318.)

<sup>\*</sup> Dorsals contiguous, the second dorsal much larger than the anal.

<sup>†</sup> Vertebræ about 10 + 14. (Sciæninæ.)

<sup>!</sup> Lower jaw included.

<sup>§</sup> Lower pharyngeals fully united, with paved teeth; second anal spine very large.

a. Lower jaw without barbels. (Fresh-water species). HAPLOIDONOTUS, 294.

aa. Lower jaw with several small barbels. (Marine species). Pogonias, 295.

<sup>§§</sup> Lower pharyngeal bones distinct.

b. Lower jaw without barbels; anal spines 2.

cc. Teeth feeble, permanent in upper jaw only; anal spines small.

LIOSTOMUS, 297.

bb. Lower jaw with several minute barbels.

d. Preopercle with its membranaceous margin crenulate.

GENYONEMUS, 298.

dd. Preopercle with its bony margin screate.....Micropogon, 299. bbb. Lower jaw with a single thickish barbel.

# Lower jaw projecting beyond upper.

j. Snout short, blunt; no canines; anal fin very smal; soft part of dorsal much longer than spinous part..................LARIMUS, 302.

tt. Vertebræ about 14+10; body elongate; lower jaw projecting. (Otolithina.)

\*\* Dorsals remote; the second about as large as the anal. (Isopisthina.)

### 294.—HAPLOIDONOTUS Rafinesque.

Fresh-water Drums.

(Amblodon Rafinesque.)

(Aplodinotus Rafinesque, Journ. de Phys. 1819, 418: type Aplodinotus grunnieus Raf.)

Body oblong, the snout blunt, the back elevated and compressed. Mouth rather small, low, horizontal, the lower jaw included. Teeth in villiform bands, the outer scarcely enlarged. No barbels. Pseudobranchiæ rather small; gill-rakers short and blunt. Lower pharyngeals very large, fully united, with coarse, blunt, paved teeth. Preopercle slightly serrate. Dorsal spines strong and high, with a close fitting scaly sheath at base, the two dorsals somewhat connected. Second anal spine very strong. Caudal double-truncate. Fresh waters of the United States. ( $\delta\pi\lambda\omega\epsilon_{7}$ , a cloak;  $\nu\tilde{\omega}\tau\sigma_{7}$ , back; according to Gill, from the scaly base of the dorsal fin.)

893. H. grunniens Raf.—Sheepshead; Thunder-pumper; Drum; White Perch; Croaker.

Grayish silvery, dusky above, sometimes quite dark, the back sometimes with oblique dusky streaks along the rows of scales. Scales rather thin, adherent, smaller on the back and belly. Second anal spine more than half the length of the head. Snont very blant, overlapping the mouth. Eye large. Head  $3\frac{1}{2}$ ; depth nearly 3. D. IX-I, 30; A. II, 7; Lat. I. 55. Great Lakes to Texas, abundant, reaching a weight of 50 to

60 pounds. Its flesh is not of high quality, and is often tough and ill-flavored, especially in the lakes.

(Aplodinotus grunniens Raf. Journ. de Phys. 1819, 88: Corrina oscula Giinther, ii, 297: Sciana grisca Le Sueur, Journ. Acad. Nat. Sci. Phila. 1822, 254: Amblodon concinnus and lineatus Agassiz, Am. Journ. Sci. Arts, 1855, 307: ? Corvina richardsoni\* Cuv. & Val. v, 100: Amblodon neglectus Grd. Mex. Bound. Surv. Ichth. 1859, 12.)

#### 295.-POGONIAS Lacépède.

#### Drums.

(Lacépède, Hist. Nat. Poiss. iii, 138, 1802: type Pogonias fasciatus Lac. = Labrus cromis L.)

Body short and deep, the dorsal outline much elevated, the ventral nearly straight. Mouth moderate, the upper jaw longest; teeth small, in villiform bands, the outer not enlarged; lower pharyngeal bones large, fully united, armed with strong paved teeth; lower jaw with numerous barbels, each about half as long as the eye; preoperculum entire, with a membranaceous edge. Dorsal fins slightly connected, the spines high and strong; candal fin subtruncate; first anal spine short, the second exceedingly large, nearly as long as the soft rays; pectorals and ventrals long; gill-rakers short and bluntish. Pseudobranchiæ large. Marine species reaching a very large size; among the largest of the Scienidæ. ( $\pi \omega \gamma \omega \nu i \alpha z$ , bearded.)

### 894. P. chromis (Linn.) C. & V.—Drum.

Grayish silvery, with 4 or 5 broad dark vertical bars, which disappear with age; fins dusky. Body oblong, much compressed;

#### EUTYCHELITHUS Jordan.

(Jordan, Man. Vert. E. U. S. ed. 1, 242, 1876: type Corvina richardsoni C. & V.)

Differs from Haploidouotus in the much deeper body, steep profile, the nearly equal jaws, the single rather short anal spine, and in the smaller size of most of the fins. ( $\dot{\epsilon} v \tau v \chi' \dot{\gamma} c$ , lucky;  $\lambda \iota \theta o c$ , stone; in allusion to the large ear-bones of Sciænoid tishes. The ear-bones of Haploidonotus are quite large and are marked with a rude impress of the letter L, and are hence known to Wisconsin boys as "lucky-stones.")

#### E. richardsoni (C. & V.) Jordan.—Maleshaganay.

Grayish olive, with darker bands across the back; body much elevated, highest in front of dorsal fin; profile very abruptly decurved. Preopercle finely serrate. Eye half length of snout. Pectorals pointed, considerably longer than ventrals. Head  $3\frac{1}{2}$  in total length, including caudal fin; depth  $2\frac{3}{4}$ . D. IX, 29; A. I, 7; Lat. l. 54. (C. & V.) Lake Huron.

(Corvina richardsonii Cuv. & Val. v, 100: Corvina richardsonii Richardson, Fauna Bor.-Amer. 1836, 64: Corvina richardsonii Günther, ii, 298.)

<sup>\*</sup> If correctly described, this species is the type of a distinct genus which has been provisionally termed *Eutychelithus*. It is probable, however, that the type was a deformed individual of *II. grunniens*.

The following are the alleged characters, generic and specific:

profile very steep, its curve uneven; ventral outline little curved. Mouth moderate, maxillary searcely reaching middle of orbit. Scales large, those on breast much smaller. Fins large, pectorals reaching beyond tips of ventrals, nearly to vent; second anal spine more than half length of head. Head above scaly, except a triangular space on snout. Head  $3\frac{1}{3}$  in length; depth  $2\frac{1}{2}$ . D. X, I, 20; A. II, 6; Lat. l. 50. Cape Cod to West Indies; abundant southward.

(Labrus cromis Linn. Syst. Nat.; Giinther, ii, 270; Holbrook, Ich. S. Car. 1860, 114: Pogonias fasciatus Holbrook, Ich. S. Car. 1860, 119: Pogonias fasciatus Giinther, ii, 270.)

#### 296.-SCLENA Linnaus.

(Johnius Bloch: Corvina C. & V.: Pseudosciana Bleeker.)

(Artedi; Linn:eus, Syst. Nat.: type Sciana umbra L.)

Body elongate, compressed, not much elevated. Head rather long. Mouth moderate or rather large, the lower jaw included. Teeth in both jaws mostly in villiform bands, the outer row often enlarged; lower pharyngeals separate, their teeth conic or paved. Chin with pores; no barbels. Preopercle with its bony posterior edge serrated, or else with a membranaceous margin. Scales moderate, in oblique series. Dorsal fins connected, the spines rather strong. Anal spines 2, the second varving in size. In this genus and most of the other Scianina the muzzle above the premaxillaries is provided with a number of pores, and near the base of the premaxillary 2 or 4 small dermal flaps are present; in all these species the preorbital is very wide, and often gibbons. Species numerous, in all warm seas. Many attempts have been made to subdivide this genus, but none of the current genera form definable natural groups, when foreign species are taken into account. (σχίαινα, Sciæna, from σχιά, shade, the classical name of Sciæna aquila:)

a. Teeth in both jaws in single series or very narrow bands.

b. Head depressed, very broad between the eyes. (Stelliferus \* Stark.)

#### 895. S. stellifera (Bloch) J. & G.

Pale above, with purplish reflections, almost translacent; below silvery; everywhere finely punctulate; fins yellowish, the tips of dorsal and pectoral blackish. Body oblong, not much elevated, little compressed; the tail slender; head short; snout blant; eye very small, 5 in head; profile depressed above the eyes; the interorbital space flattish, extremely broad; a slight ridge above each orbit, these meeting

<sup>\*</sup> Stark, Elements Nat. Hist. i, 459, 1828: type Bodianus stellifer Bloch.

above the snout. Mouth oblique, the lower jaw scarcely shorter than the upper; the maxillary extending to below the middle of the small eye. Teeth as in S. punctata, but with series of larger teeth less developed and the villiform band broader. Preorbital full, cavernous; preopercle cavernous, its margin with a few strong teeth. Pseudobranchiæ well developed. Gill-rakers long and slender. Dorsal spines slender; caudal strongly convex; second anal spine rather long, slender, nearly as long as soft rays. Ventral outline nearly straight. Vent a little nearer preopercular margin than base of caudal. Pectorals short, not reaching tips of ventrals. Head 3½ in length; depth 3. D. XI, I, 22; A. II, 9; Lat. l. 50. West Indies, north to Virginia. Here described from a specimen from Pensacola.

(Bodianus stellifer Bloch, Ichth. taf. 231: Cheilodipterus acoupa Lacépède, iii, 546: Corvina trispinosa Cuv. & Val. v, 109: Homoprion lanceolatus Holb. Ich. S. Car. 1860, 167: Scierna lanceolata Günther, ii, 289: Stelliferus lanceolatus Gill, Report U. S. Fish Comm. 1872-73, 805: ? Corvina stellifera Günther, ii, 299 = Corvina microps Steind. Ichth. Notiz. i, 6, 1864, said to be distinguished from S. stellifera by the smaller eye (6 in head), narrower interorbital space (2½ in head) and weaker serrae on the preopercle. Perhaps more than one species is here included.)

b. Head normal, parrow between the eyes. (Bairdiella Gill.)

### 893. S. punctata (Linn.) J. & G.—Silver Perch; Yellow-tail; Mademoiselle.

Greenish above, silvery below, each scale with a series of dark punctulations through the centre, usually very conspicaous, sometimes obscure, these forming narrow somewhat irregular streaks along the sides: fins plain, the caudal vellowish. Body oblong, compressed, rather robust. Head compressed, conical, not specially depressed, nor broadened; preoperculum scarcely cavernous, strongly serrated or spinous at its angle; interorbital region depressed, transversely convex, narrower than eye. Mouth rather large, somewhat oblique, maxillary reaching about to middle of orbit; jaws subequal; both jaws with stout recurved teeth, behind which in the upper jaw are a few series of smaller teeth; teeth in the lower jaw mostly in one series, outside of which are a few smaller Dorsal spines moderate; anal fin small, placed unusually far back, coterminous with the second dorsal. Second anal spine strong, nearly as long as the soft rays. Scales in less oblique series than usual. Gill-rakers long and slender. Soft dorsal and anal fins considerably scaly; pectoral fin quite short, not reaching half way to anal; caudal fin double truncate. Lower pharyngeals small, with sharp teeth.

<sup>&</sup>quot;Gill, Proc. Acad. Nat. Sci. Phila. 1861, 83: type Bodianus argyroleucus Mitch. (Dedicated to Spencer F. Baird.)

rather large, equal to snout, 4 in head. Preorbital narrow. Head 3\frac{1}{3}; depth about 3. D. XI-I, 22; A. II, 9; Lat. l. 50. Cape Cod to Florida; abundant southward.

(Perca punctata Linn. Syst. Nat. (two species of the same name): Bodianus argyroleneus Mitch. Trans. Lit. and Phil. Soc. N. Y. 417, pl. 6, fig. 3: Corvina argyrolenea Günther, ii. 299: Homoprion xanthurus Holbrook, Ich. S. Car. 1850, 164.)

aa. Teeth in both iaws in broad bands.

- c. Preopercle with its bony margin serrate.
  - d. Outer teeth in upper jaw considerably enlarged. (Scienops\* Gill.)

### 897. S. iacobi (Steind.) J. & G.

Body moderately elevated; mouth moderate, rather inferior; maxillary reaching middle of eye; outer row of teeth in each jaw slender. somewhat enlarged, those in upper jaw much larger than in lower; preoperele finely serrate. Dorsal spines very slender, the fourth half length of head, higher than the soft rays; second anal spine more than twice as strong as dorsal spines, as long as from middle of eye to edge of operele, lower than the soft rays. Caudal trancate or slightly concave: pectoral shorter than ventrals, the first ray of the latter being filamentous. Scales on body and head ctenoid. Silvery gray, darker above; three dark brown longitudinal stripes along sides, the lower broadest, extending from eye to middle of candal, the middle one running to upper edge of tail, the upper to soft dorsal; below these stripes are sometimes feebler ones, besides brownish lines following the rows of scales; fins plain, more or less punctulate; markings probably less distinct in the adult. Head 3; d pth 3. D. X-I, 27; A. H. 8; scales 11-56-16. San Diego, California. (Steindachner.)

(Corvina (Johnius) jacobi Steind, Ichth, Beiträge, viii, 3, 1879.

### 898. S. ocellata (L.) Gthr.—Channel Bass; Red Horse; Red Bass.

Grayish silvery, iridescent; scales with dark spots forming faint irregular undulating stripes; upper part of base of caudal with an oval black spot as large as the eye, bordered by white or orange, this spot often duplicated. Body rather elongate, not much elevated, compressed behind, an almost even curve from snout to base of dorsal; preopercle distinctly serrate; eye large, 1½ in snout, 5½ in head; gill-rakers short and thick; mouth large, maxillary nearly reaching the posterior margin of the orbit. Caudal truncate; second anal spine rather strong, two-thirds as long as first ray; pectoral fins very short, not reaching half way to anal. Lower pharyngeals narrow, with conical teeth. Head 3½;

depth 3½. D. X-I, 25; A. II, 8; Lat.'l. 50. Cape Cod to Mexico; common southward; known at sight by the peculiar caudal spot.

(Perca ocellata L. Syst. Nat.: Corvina ocellata Cuv. & Val. v, 134: Corvina ocellata Holbrook, Ich. S. C. 1860, 150; Günther, ii, 289.)

dd. Outer teeth in upper jaw scarcely larger than others; lower pharyngeals enlarged, their teeth paved. (Roncador\* J. & G.)

### 899. S. stearnsi (Steindachner) Jor. & Gilb.—Roncador.

Gravish silvery, with bluish lustre, some streaks of dark points along the rows of scales; breast and belly with two dusky lengthwise streaks; a very conspicuous, large, jet black spot at base of pectoral, including the axil and the base of the fin; fins grayish, with dusky shades; inside of mouth, branchiostegals, and peritoneum mostly black. Body oblong, heavy forward, the shoulders elevated and the profile steep; mouth rather large, maxillary reaching beyond middle of eye. Teeth in both jaws in a broad villiform band, the outer row searcely enlarged; no canines; preopercle strongly dentate; gill-rakers slender, rather short; lower pharyngeals broad, the teeth mostly paved; eye large. dorsal not much elevated; second anal spine shortish, about half the height of the soft rays, very stout; pectoral elongate, reaching much past the tips of the long ventrals; caudal fin lunate, the upper lobe the longer. Head 3\(\frac{2}{3}\); depth 3. D. X-I, 24; A. II, 8; Lat. l. 60. L. 30 inches. Coast of California, north to Point Concepcion; a large and valued food-fish, singularly distinguished by its black pectoral spot.

(Corrina stearnsi Steindachner, Ichthyol. Beiträge, iii, 1875, 22: Roncador stearnsi Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 28.)

cc. Preopercle with an entire, membranaceous border.

d. Dorsal with less than 30 soft rays. (Scianat.)

### 900. S. saturna (Grd.) J. & G.-Red Roneador.

Blackish, with coppery lustre; each scale with a cluster of dark points; a dark opercular patch; fins rather dark; belly silvery, but dusted with dark specks. Body oblong, with the antedorsal region convex and the profile nearly straight. Maxillaries not reaching to posterior border of eye. Teeth in lower jaw in a broad villiform band; upper jaw with a similar band, in front of which is a single row of large teeth; lower pharyngeals narrow, with conical teeth. Gill-rakers short

<sup>\*</sup> Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 28: type Corvina stearnsi Steindachner. (Spauish roncador, grunter.) This is perhaps a valid genus, distinguished from Sciana by its large, paved pharyngeals, resembling those of Pogonias, but not united.

<sup>†=</sup>Corrina Cuvier, Règne Anim. ed. 2, ii, 173, 1829: type Sciana nigra Bloch=Sciana umbra L. None of the species of the group called Sciana by Cuvier were known to Linnaus.

and thick. Scales on head etenoid. Second anal spine very stout, nearly as high as the soft rays; caudal fin slightly lunate. Head  $3\frac{1}{2}$ ; depth  $2\frac{3}{3}$ . D. X-I, 23; A. II, 7; Lat. l. 55. Pacific coast, north to Point Concepcion.

(Amblodon saturnus Grd. U. S. Pac. R. R. Surv. Fish. 93: Rhinoscion saturnus Gill, Proc. Acad. Nat. Sci. Phila. 1861, 85: Corrina saturna Günther, ii, 298.)

dd. Dorsal with more than 30 soft rays. (Pareanes\* Gill.)

# 901. S. acuminata (Bloch & Schneider) J. & G.

Everywhere blackish, with traces of about 10 narrow horizontal streaks along the sides; spinous dorsal quite black. [Young specimens vellowish, with 7 or 8 straight longitudinal dark bands about as wide as the interspaces; dorsal fin similarly banded.] Form of S. saturna, the back somewhat elevated, the profile steep and nearly straight from the tip of the conical and rather pointed shout to the base of the dorsal. Mouth not large, the maxillary extending to below the middle of the eve. Lower jaw included: both jaws with broad bands of villiform teeth, the anterior series in the upper jaw considerably enlarged. Scales on the head scarcely etenoid above, eveloid on the cheeks. Gill-rakers short, rather stout. Pectorals very short, not reaching half way to the tips of the ventrals, and but half way to the anal; as long as from the snout to the edge of the preopercle; anal fin small, its tip not reaching to the last ray of the second dorsal, its spine robust, nearly as high as the fin, half the length of the head; first dorsal small, with slender spines; second dorsal very long, its tip nearly reaching caudal. Eye rather large. Head 3; depth 3. D. IX, I, 36; A. II, 7; Lat. 1. 53. West Indies to Florida. Here described from a specimen lately taken by Mr. Silas Stearns at Pensacola, Fla.

(Grammistes acuminatus Bloch & Sehn. 1801, 184: Eques acuminatus Günther, ii, 280: Pareque acuminatus Gill, I. c.)

### 297.—LIOSTOMUS Lacépède.

### Spots.

(Liostomus Lacépède, Hist. Nat. Poiss. iv, 439, 1802: type Liostomus xanthurus Lac.)

Body oblong, ovate, the back compressed. Head obtuse. Mouth small, horizontal, the upper jaw with a band of feeble teeth, the lower nearly or quite toothless; lower pharyngeals separate, the teeth paved. Preopercle with a membranaceous border. Dorsal spines 10, slender, rather high, the last connected with the soft rays; anal spines 2, the

<sup>\*</sup>Gill, in Goode, Bull. U. S. Nat. Mus. 1876, v, 50: type Grammistes acuminatus Bloch & Schneider.  $(\pi\alpha\rho\alpha$ , near: Eques.)

second not large; caudal fin emarginate. Gill-membranes slightly connected; gill-rakers slender. ( $\lambda \epsilon \tilde{\iota} v_{5}$ , smooth;  $\sigma \tau \delta \mu a$ , mouth—the mouth having been originally described as toothless.)

### 902. L. xanthurus Lac. - Spot; Goody; Oldwife; La Fayette.

Bluish above, grayish silvery below; sides with about 15 dark bands, extending from the dorsal obliquely forward to below the lateral line; a distinct round dark humeral spot; fins plain olivaceous; caudal not yellow. Profile steep; snout blunt and gibbous; interorbital region narrow. Fins small, the spines weak; second anal spine about half as long as the longest soft ray; upper lobe of caudal longest. Head 3½; depth 3. D. X, I, 32; A. II, 12; Lat. l. 60. L. 12 inches. Cape Cod to Florida; a valuable food-fish southward.

(Lacépède, iv, 439; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 32: Homoprion xanthurus Holbrook, Ich. S. C. 1860, 164: Sciwna xanthurus Giinther, ii, 288: Mugil obliquus Mitchill, Trans. Lit. and Phil. Soc. N. Y. i, 405: Liostomus obliquus Holbrook, Ich. S. C. 1860, 160: Sciana obliquu Giinther, ii, 288: Leiostomus humeralis and xanthurus C. & V. 141, 142. The alleged species "obliquus" and "xanthurus" differ in color, "xanthurus" being plain golden, without spots or bars; tail yellow; probably based on faded museum specimeus.)

#### 298.-GENYONEMUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1831, 87: type Liostomus lincatus Ayres.)

Body clongate, moderately compressed, the back little elevated. Head oblong, the snout abruptly decurved. Eyes moderate, anterior. Preopercle with a crenulated membranaceous edge. Mouth rather large, subterminal, somewhat oblique. Lower jaw with several very small barbels and with a few large pores. Teeth equal, in villiform bands, the anterior series scarcely enlarged. First dorsal with about 13 spines; anal with 2 spines, the second short and feeble; caudal emarginate. Pharyngeal bones and teeth as in *Micropogon*. Air-bladder simple. Gill-rakers slender, rather long. Size small. (γενος, lower jaw; νημα, barbel.)

# 903. G. lineatus (Ayres) Gill.—Little Roncador.

Silvery with brassy lustre and black punctulations, these forming faint oblique dark lines along the rows of scales; fins yellowish; axil black. Head conic, rather blunt; maxillary reaching silghtly beyond middle of pupil. Barbels 5-8, minute, on the inner edge of each dentary bone. Anal spines very small, the second not half the height of the soft rays; pectorals and ventrals moderate, not reaching vent; caudal concave. Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ . D. XIII, I, 22; A. II, 11; Lat. l. 55.

L. 10 inches. Pyloric eœca 8; air-bladder simple. Coast of California; very common.

(Liostomus lineatus Ayres, Proc. Cal. Acad. Nat. Sci. i, 25, 1855; Girard, U. S. Pac. R. R. Surv. Fish. 99: Sciwna lineata Günther, ii, 288.)

### 299.—MICROPOGON Cuvier & Valenciennes.

#### Croakers.

(Cuv. & Val. Hist. Nat. Poiss. v, 213, 1830: type Micropogon lineatus C. & V. = Perca undulata L.)

Body moderately elongate, compressed, somewhat elevated. Preopercle strongly dentate. Teeth in villiform bands, the outer row in the upper jaw enlarged; lower jaw with a row of minute barbels on each side. Second anal spine moderate. Caudal fin double truncate. Lower pharyngeals narrow, distinct, with conical teeth. Gill-rakers moderate, rather slender. Air-bladder with long horns. ( $\mu\nu\nu\rho\delta\varepsilon$ , small;  $\pi\delta\gamma\omega\nu$ , beard.)

## 901. M. undulatus (L.) C. & V.—Croaker.

Color grayish-silvery, with bright reflections; sides and back with narrow, irregular, undulating lines of dots; dorsal fins with three lines of dots along base. Body rather elongate, slightly elevated, the back somewhat compressed. Head long, the snout prominent, not strongly convex. Month rather large, nearly horizontal, the maxillary reaching to front of eye. Eye 2 in snout. Preoperele strongly serrate; the spines near angle diverging. Dorsals nearly separate, the first high; pectorals moderate, nearly reaching tips of ventrals; ventral filamentous; anal inserted nearly under middle of second dorsal; the second spine rather weak, shorter than snout, one-third length of head. D. X, I, 27; A. II, 8; Lat. l. 60; cœca 8. Head  $3\frac{1}{8}$ ; depth  $3\frac{1}{2}$ ; eye 5 in head, rather less than interorbital width. L. 12 inches. New York to West Indies; common southward.

(Perea undulata L. Syst. Nat.; Cuv. & Val. v, 219; Holbrook, Ich. S. Car. 1860, 146; Günther, ii, 271: Micropogon lineatus Cuv. & Val. v, 215.)

#### 300.-UMBRINA Cuvier.

(Cuvier, Règne Anim. ed. 1, 297, 1817: type Sciana cirrhosa L.)

Body moderately elongate; back somewhat arched. Head oblong, with the snout thick and protuberant. Mouth almost horizontal, of moderate size. Preoperculum with its bony margin finely serrate. Lower jaw with a single thickish barbel. Teeth in villiform bands, the outermost in the upper jaw somewhat enlarged. Anterior dorsal

with about 10 spines; anal fin with 2 spines, the second not very small. Caudal lunate or truncate. Gill-rakers normal, but short. Air-bladder present. In most warm seas. (Latin, *umbra*, shade; the name *umbra* was used for the typical species by early writers.)

a. Sides without vertical bars.

## 905. U. roncador Jor. & Gilb .- Yellow-finned Roncador.

Bright silvery, bluish above, with brassy reflections; sides with narrow, distinct, undulating streaks of deep olive, running from the head and pectoral region upward and backward, with some abrupt curvatures, to the base of the dorsal fin, sometimes alternating with lines of spots; no vertical bars; cheeks pure white; fins mostly yellow; peritoneum black. Body elliptical-elongate, the back somewhat elevated, the curve from snout to dorsal regular. Head conical, bluntish. Mouth horizontal, the maxillary extending to beyond front of pupil; eye moderate,  $1\frac{1}{2}$  in snout,  $5\frac{1}{2}$  in head,  $1\frac{1}{3}$  in interorbital width. Caudal lunate, the upper lobe the longer. Second anal spine strong,  $2\frac{1}{2}$  in head, a little shorter than third dorsal spine. Pectoral short and small, not reaching tips of ventrals, and not half way to vent; its length  $1\frac{1}{2}$  in head. Head  $3\frac{4}{5}$ ; depth  $3\frac{1}{3}$ . D. X-I, 27; A. II, 7; Lat. 1. 58. L. 15 inches. Point Concepcion to Panama abundant; one of the handsomest of the Sciænoids.

(Jor. & Gilb. Proc. U. S. Nat. Mus. 1881: Umbrina undulata Steindachner, Ichthyol. Beiträge, iii, 21, 1875; not of Girard.)

aa. Sides with vertical bars.

## 906. U. broussoneti Cuv. & Val.

Body with about 9 dark cross bands, besides undulating streaks along the rows of scales; spinous dorsal blackish. Body rather stout, the back somewhat elevated; maxillary extending to pupil; preopercle finely denticulate on its bony edge; barbel short; pectoral fins short and small, not reaching to tips of ventrals nor half way to vent; caudal truncate; second anal spine thick,  $\frac{2}{5}$  the length of the head. Eye  $3\frac{2}{3}$  in head. Head  $3\frac{3}{4}$ ; depth 3. D. X-I, 28; A. II, 7; scales 5-48-10. West Indies, north to East Florida.

(Cuv. & Val. v, 187; Günther ii, 277; Jordan, Proc. U. S. Nat. Mus. 1880, 17: Umbrina coroides Cuv. & Val. v, 187.)

### 303.-MENTICIRRUS Gill.

King-fish.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 86: type Perca alburnus L.)

Body comparatively elongate, little compressed; head long, subconic, the bluntish snout considerably projecting beyond the mouth; mouth small, horizontal, both jaws with bands of villiform teeth, the outer teeth in the upper jaw more or less enlarged; chin with a single stoutish barbel; preopercle with its membranaceous edge serrulate; gill-rakers short, tubercular; dorsal spines high, slencer; second dorsal long and low; caudal fin with the lower angle rounded, the upper sharp; anal fin with a single weak spine; no air-bladder. Lower pharyngeals separate, small, with sharp teeth. Species numerous in American waters. (Latin, mentum, chin; cirrus, barbel.)

a. Outer row of teeth in upper jaw not greatly enlarged.

## 907. M. nebulosus (Mitchill) Gill.—Whiting; King-fish; Barb.

Bright grayish silvery, with irregular dark bars, those in front running obliquely backward and downward, those behind obliquely forward and downward; fins all dusky. Body elongate, terete, but little compressed; snout very blunt; profile evenly curved; eyes very small, about 2 in snout; outer teeth not much enlarged; pectoral fins short and broad, scarcely reaching tips of ventrals,  $1\frac{1}{3}$  in head; ventrals  $1\frac{3}{4}$  in head; dorsal fins scarcely connected; spinous dorsal high, its height three-fourths length of head; anal spine very weak, less than half the height of fin. Head  $3\frac{3}{4}$  in length; depth  $4\frac{3}{4}$ . D. X-I, 26; A. I, 8; Lat. l. about 68. Cape Cod to Cape Hatteras; common northward; an important food-fish.

(Sciana nebulosa Mitch. Trans. Lit. and Philos. Soc. N. Y. i, 408, 1815: Umbrina nebulosa Giinther, ii, 275.)

## 908. M. littoralis (Holbrook) Gill.—Surf Whiting.

This species is said to be distinguished from *M. alburnus* by the plain silvery color and the absence or reduction of the outer series of larger teeth. Form entirely similar to that of *M. alburnus*. D. X-I, 27; A. I, 9. Coast of South Carolina. (Holbrook.)

(Umbrina littoralis Holbrook, Ich. S. Car. 1860, 144: Umbrina littoralis Günther, ii, 276.)

aa. Outer row of teeth in upper jaw much enlarged.

## 909. M. alburnus (Linn.) Gill.-Whiting.

Silvery, faintly clouded along the back and sides, these marks forming dusky bars, running obliquely forward and downward to below the lateral line, sometimes obsolete. Body clongate, rather slenderer than in *nebulosus*; back slightly arched; belly nearly straight. Snont broad, depressed, and bluntish, protruding beyond the month. Onter teeth of upper jaw very strong. Maxillary reaching to below middle of the small eye. Third dorsal spine highest, less than half the length of the soft dorsal, and two-thirds the length of head; pectorals broad,

Bull. Nat. Mus. No. 16——37

rather long, their tips reaching beyond ventrals, their length 1½ in head; ventrals 2 in head. Head 3½ in length; depth about 4. D. X-I, 25; A. I. 7; Lat. l. 65. South Atlantic coast of United States.

(Perca alburuns Linn. Syst. Nat.: Umbrina alburuns Günther, ii, 275: Umbrina alburuns Holb. Ich. S. C. 1830, 137: Umbrina phalana Girard, Mex. Bound. Surv. Ichth. 1859, 13.)

## 910. M. undulatus (Grd.) Gill.—Bagara; "Sucker".

Sooty grayish, with bright reflections, the back, all the fins, and under side of the head dusky with dark points; undulating lines along sides running upward and backward; back often with very faint dark cross-bars. Body elongate, the back not elevated. Head bluntish. Eye small,  $2\frac{1}{2}$  in snout, 7 in head, the maxillary scarcely extending to its front. Anterior teeth of upper jaw strong. First dorsal high, its longest spine reaching past front of second dorsal; anal small, nearly under the middle of second dorsal,  $1\frac{1}{2}$  in head; pectoral fins reaching past tips of ventrals nearly to vent, their length  $1\frac{1}{9}$  in head. Head 4; depth 4. D. X-I, 26; A. I, 8; Lat. l. 60. L. 18 inches. Pacific coast, from Panama north to Point Concepcion; abundant.

(Umbrina undulata Girard, Proc. Acad. Nat. Sci. Phila. 1854, 148, and in U. S. Pac. R. R. Snrv. Fish. 101 (the type, a very young specimen, examined by us): Umbrina clongata Günther, Proc. Zoöl. Soc. London, 1864, 148.)

### 302.-LARIMUS Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. v, 145, 1830: type Larimus breviceps C. & V.) Body oblong, compressed; snout very short and blunt; mouth very oblique, large, the lower jaw projecting; teeth small, in villiform bands; no barbels; preopercle finely serrated; pseudobranchiæ present; airbladder simple; vertebræ as usual; lower pharyngeals distinct, with pointed teeth; dorsal fins connected, the first moderate, the second long; anal fin very small, placed well back, provided with 2 spines; caudal fin convex. (An ancient name of some fish, from λαρός, pleasant, dainty.)

#### 911. L. fasciatus Holbrook.

Silvery gray, clouded above; sides marked with about 7 nearly vertical dusky bars, running from the back to below the lateral line. Body oblong, compressed, ventral outline nearly straight, dorsal outline considerably arched; snont very short, much less than the diameter of the large eye; mouth large, very oblique, maxillary nearly reaching posterior margin of orbit; tip of mandible on level of lower part of pupil;

second anal spine small; pectoral fin short and candal subtruncate. Head 3½; depth about 3. D. X-I, 24; A. II, 6; Lat. l. about 62. (Holbrook.) South Atlantic coast and southward; rare.

(Holbrook, Ich. S. C. 1860, 154; Günther, ii, 269.)

### 303.—ATRACTOSCION Gill.

(Gill, Proc. Acad. Nat. Sci. Phila, 1832, 18: type Otolithus aguidens Cuy. & Val.)

This genus differs from *Cynoscion* only in the dentition, the bands of teeth being somewhat broader and some of the teeth near the middle of the upper jaw enlarged, but not forming cauines. The species are among the largest of the *Scienide*, and as food-fishes they are among the best. ( $\alpha\tau\rho\alpha z\tau\sigma\tau$ , a spindle;  $\sigma z\tau\sigma\tau$ , Sciena.)

912. A. nobile (Ayres) Gill.—White Sea Bass; Sea Trout; Corvina.

Dull silvery, bluish above; everywhere punctulate; young with obscure. dusky cross-bars; axil and fins dusky. Body clongate-elliptical, not much compressed; head slender, conical, the snout rather pointed: month terminal, oblique, the lower jaw the longer; maxillary reaching to beyond pupil; premaxillary in front on the level of the orbit; teeth in lower jaw enlarged and in a single row laterally, anteriorly smaller, in a broad patch, the inner series in both jaws reflexed and movable; upper jaw with about two series on sides forming a broad cardiform patch in front; a few of the teeth near the middle of the jaw enlarged but not canine-like; gill-rakers moderate, very strong; scales very thin, weakly ctenoid; anal spines 2, weak, the first sometimes obsolete; fins low, pectoral not reaching half way to vent; caudal lunate, the upper lobe generally longest. Head 3½; depth 4. D. X-I, 21; A. II, 9; Lat. l. 88 (tubes); more than 100 series of scales. Pacific coast north to San Francisco; one of the largest and most valuable of our Scienoid fishes, reaching a weight of 60 to 70 pounds. The flesh is firm and rich.

(Johnius nobilis Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 78; Gill, Proc. Acad. Nat. Sci. Phila. 1862, 18; Otolithus californeusis Steindachner, Ichth. Beiträge, iii, 31, 1875, the young or "Sea Trout.")

#### 301.-CYNOSCION Gill.

Weak-fishes.

(Cestreus Gronow; not of C. & V.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 49: type Johnius regalis, Bloch.)

Body clongate, little compressed; the back not elevated. Head conical, rather pointed. Month larger than in our other Scienoids; the lower jaw projecting. Maxillary very broad. Teeth sharp, not closely

set, in rather narrow bands; the lower jaw without canines; upper jaw with two long canines, one of which is sometimes obsolete; lateral teeth of lower jaw larger than anterior. Preopercle with its membranaceous edge serrulate, the bone entire. Lower pharyngeal bones separate, their teeth all pointed. Gill-rakers strong, rather long. Vertebræ about 14+10 (instead of 10+14 as in Sciænoids generally). Pseudobranchiæ well developed. Dorsal spines slender; anal spines 1 or 2, very feeble; second dorsal long and low; caudal fin subtruncate or lunate. Large fishes chiefly of the waters of America, closely related to the Old World genus Otolithus, from which they are distinguished by the absence of canines in the lower jaw. All of them rank high as foodfishes; the flesh is rich, but tender and easily torn; hence the popular name of Weak-fishes. (zówz, dog; σzιωz, Sciæna; the modern Greek name of Umbrina cirrhosa.)

a. Anal spines 2.

# 913. C. parvipinne Ayres.—Blue-fish; Corvina.

Clear steel-blue above, without stripes or spots, silvery below; a narrow dusky shade along the sides below the lateral line; axil dusky; lower fins yellowish with dusky shading; upper fins dark; the second dorsal dark-edged. Body elongate, compressed, little elevated. Head conic, rather pointed. Month large, the maxillary extending to beyond the pupil. Eye large, a little shorter than snout, 6 in head. Teeth moderate, in a rather broad band; canines very long and strong, usually but one present. Fins rather low; caudal lunate; pectoral short, not reaching to the tips of the ventrals. Gill-rakers strong, rather long. Head  $3\frac{1}{2}$ ; depth  $4\frac{1}{4}$ . D. IX-I, 23; A. II, 10; the first anal spine extremely small. Lat. l. with 75 tubes; the number of scales about 95. L. 30 inches. Pyloric coca 3. Air-bladder long, with two appendages. Coast of California and Mexico, chiefly south of Sanţa Barbara. An excellent food-fish.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1861, 156: Otolithus magdalenæ, Steindachner, Ichth. Beiträge, iii, 1875.)

aa. Anal spine single.

c. Back uniform silvery white, without dark spots or blotches.

## 911. C. mottum Holb .- White Trout: Sea Trout.

Uniform bright silvery, bluish above. Body elongate, little compressed. Back more arched than in the other species. Month moderate, oblique; lower jaw longest; maxillary reaching opposite middle of eye. Eye large, about as long as snout. Head 3\frac{1}{4}; depth 3\frac{3}{4}. D. X-I, 28 (X-

I, 25, Günther); A. I, 10; Lat. l. about 68. (Holbrook.) Coast of South Carolina and southward.

(Otolithus nothus Holbrook, Ich. S. C. 1830, 134: Otolithus nothus Günther, ii, 308.) cc. Back irregularly speckled and blotched, the spots forming undulating streaks.

## 915. C. regate (Bloch & Schneider) Gill.—Weak-fish; Squeteague; Gray Trout.

Silvery, darker above and marked with many small, irregular dark blotches, some of which form undulating lines running downward and forward; back and head with bright reflections; dorsal and caudal fins dusky; ventrals, anal, and lower edge of candal yellowish, sometimes speckled. Maxillary reaching to beyond pupil; teeth sharp, in narrow bands. Pectorals short, scarcely reaching tips of ventrals, a little more than half length of head; longest dorsal spine as long as maxillary, not half length of head. Head 3½ in length; depth 4½. Eye about 1½ in snout. D. X-I, 29; A. I, 13; Lat. 1.78. Cape Cod to South America; very abundant, and highly valued as a food-fish.

(Johnius regalis Bl. & Schn. 1801, 75: Otolithus regalis Holbrook, Ich. S. C. 1860, 129: Otolithus regalis Günther, ii, 307.)

## 916. C. thalassinum (Holb.) Gill.

Silvery, darker above, and marked with many interrupted narrow dark lines, directed from back obliquely forwards; belly yellow, the color running up on the sides. Body longer and less elevated than in the preceding, and with a sharper snout. Head 3½ in length; depth about 4½. D. X-I, 26; A. I, 9. South Atlantic coast of United States. A doubtful species, distinguished from C. regale by the fewer fin rays. (Otolithus thalassinus Holbrook, Ich. S. C. 1860, 133; not Otolithus thalassinus Günther, ii, 308.)

bbb. Back and upper fins with many conspicuous round black spots.

## 917. C. mancalatam (Mitchill) Gill.—Spotted Sea Trout.

Bright silvery, darker above; back posteriorly with numerous round black spots as large as the pupil; both dorsal and caudal fins marked with similar, somewhat smaller spots, much as in a trout; anal dusky. Maxillary reaching to posterior edge of eye; canines moderate. Longest dorsal spine not quite half the length of the head; pectorals short, not reaching tips of ventrals, not half length of head; caudal lunate. Head 3½; depth 5. Eye large, about 6 in head. D. X-I, 25; A. I, 10; Lat. l. about 90. Virginia to Mexico; very abundant southward.

(Labrus squeteague var. maculatus Mitchill, Trans. Lit. & Phil. Soc. i, 396, 1845; Otolithus carolinensis Cuv. & Val. ix, 475; Otolithus carolinensis Holbrook, Ich. S. C. 1860, 72; Otolithus carolinensis Giinther, ii, 305; Otolithus drummondi Girard, U. S. Mex. Bound Surv. Ichth. 1859, 13; not of Richardson?.)

### 305.—SERIPHUS Avres.

# Queen-fishes.

(Ayres, Proc. Cal. Acad. Nat. Sci. pt. ii, 80, 1861: type Seviphus politus Ayres.)

Body oblong, compressed, covered with rather large, deciduous, etenoid scales. Head deep, compressed, carinated behind, depressed above the eye. Snout bluntish, lower jaw projecting. Mouth large, oblique. Teeth small, sharp, separated, in narrow bands. Gill-rakers long. Pseudobranchiæ present. Preopercle with its membranaceous edge denticulated. Fins fragile, the soft parts scaly; dorsal fins well apart, the second unnsually small, scarcely larger than the anal, which is unusually large; anal spines 2, feeble; caudal fin lunate. Vertebræ 14+10, as in *Otolithinæ*. Size small. ( $\sigma \xi \rho \iota \varphi \sigma \xi$ , a small winged insect; also a kind of wormwood; the allusion not evident.)

## 918. S. politus Ayres .- Queeu-fish; King-fish.

Bhush above, sides and below bright silvery, finely punctate; vertical fins all pale yellow; base of pectorals blackish. Body oblong, compressed. Depth of head \(\frac{3}{4}\) its length. Mouth very large, oblique, the tip of the mandible on the level of the pupil, the broad maxillary reaching to the posterior margin of the pupil. Teeth small, sharp, separated, in about two series in front and one behind. Gill-rakers \( \) diameter of Scales etenoid, very deciduous. Spines very slender. Soft parts of vertical fins largely covered with small decidnous scales. Dorsals well separated, the second inserted in advance of the anal, which extends much further back; caudal concave; pectorals small, barely reaching tips of the small ventrals. Flesh very tender. depth 33. D. VIII-I, 20; A. II, 21; Lat. l. about 60. L. 12-14 inches. Coast of California; very abundant southward; north to San Francisco. (Ayres, Proc. Cal. Acad. Nat. Sci. ii, 80, 1831; Gill, Proc. Acad. Nat. Sci. Phila. 1862, 277.)

# FAMILY XCII.—GERRIDÆ.

# (The Gerroids.)

Body oblong or elevated, compressed, covered with sparoid scales; lateral line continuous; mouth moderate, extremely protractile, descending when protruded, the spines of the premaxillary extending to above the eye, closing a deep groove in the top of the head; maxillary without supplemental bone, not slipping under the very narrow preorbital; its surface silvery, like the rest of the head; base of mandible scaly,

a slit between it and the preorbital to permit its free motion; both jaws with slender, villiform teeth; no incisors, canines, nor molars; no teeth on vomer or palatines; preopercle entire or serrate; sides of head scaly; nostrils double, round; pseudobranchiæ concealed; gill-takers short, broad; gill-membranes separate, free from the isthmus; dorsal fin single, continuous or deeply notched, the spinous and soft portions about equally developed, with a scaly sheath along the base, as in *Embiotocidæ*; dorsal spines usually 9 or 10; anal usually with 3 spines; the soft portion of the fin similar to the soft dorsal, but shorter; ventral fins thoracic, I, 5; branchiostegals 6; lower pharyngeal bones firmly united, with a suture; air-bladder present; pyloric cæca rudimentary; vertebræ 10–14. Oviparous. Species about 30, inhabiting the tropical seas. They differ considerably in form, and in development of spines, but probably all may be referred to a single genus.

(Gerrida Günther, iv, 252-264.)

## 306.-GERRES Cuvier.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type Gerres plumieri Cuv. & Val.)

Character of the genus included above. (An ancient Latin name of some similar fish.)

a. Preopercle serrate; second spines of dorsal and anal much enlarged. (Gerres.)

#### 919. G. plumieri Cuv. & Val.

Brilliant silvery, a blackish stripe along each row of scales, making about 12 streaks, the upper concurrent with the back and thus strongly enryed; fins, except the pectorals, dusky. Body compressed, the back much elevated, the profile steeply descending and somewhat concave, the snout rather pointed; lips full, mouth quite small, the maxillary reaching front of the pupil of the large eye, which is longer than snout,  $3\frac{1}{2}$  in head; three rows of scales on check; scales large, smooth, adherent; longest dorsal spine nearly as long as head, longer than longest anal spine; pectorals narrow, pointed, reaching past tips of ventrals to anal; caudal forked; ventral with a large accessory scale. Lat. I. conspicuous, its scales 38. Head  $3\frac{1}{3}$  in length; depth 2. D. IX, 12; A. HI, 9, the last rays not much higher than the scaly sheath. West Indies, north to Eastern Florida.

(Cuv. & Val. vi, 452; Günther, iv, 253.)

aa. Preopercle cutire; second spines of dorsal and anal little enlarged. (Diapterus\* Ranzani.)

<sup>\*</sup> Diapterus Ranzani, N. Comm. Ac. Sc. Bol. 1841: = Eucinostomus B & G. ( $\delta \iota c \pi \tau \varepsilon - \rho o \delta$ , having the fin divided.)

## 920. G. argentens (Baird & Girard) Günther.

Silvery, without spots or streaks on body or fins; young sometimes barred. Mouth very small, maxillary reaching slightly beyond vertical from front of eye; scales large; spinous part of dorsal as long as soft; second dorsal spine searcely half the length of head; soft dorsal extending a little further back than anal. Eye 3 in head Head 34; depth 3. D. IX, 10; A. III, 7 or 8. New Jersey to North Carolina.

(Eucinostomus argenteus Baird & Girard, Ninth Smithsonian Report, 1854, 335.)

## 921. G. homenymus (Goode & Bean) J. & G.

Silvery, brownish above, centre of scales with a darker spot; a black spot on spinous dorsal; young with transverse dark bars. Body oblong, compressed, highest at front of spinous dorsal; profile steep, not arched; mouth horizontal, maxillary reaching to below eye; eye large. Head  $3\frac{2}{7}$  in length; depth  $2\frac{1}{3}$ ; eye 3 in head. D. IX, 10; A. III, 8. L. lat. about 40. (Baird & Girard.) Atlantic coast of the United States; abundant southward.

(Diapterus homonymus Goode & Bean, Proc. U. S. Nat. Mus. ii, 340, 1879: Eucinostomus argenteus Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 17, not of B. & G.: Gerres argenteus Günther, iv, 256.)

## 922. G. harengulus (Goode & Bean) J. & G.

"The height of the body is contained 3 to  $3\frac{1}{5}$  times in the total length without caudal, the length of the head 3\frac{1}{2} to 3\frac{1}{2} times; the diameter of the eye excels the length of the snout and is contained 3 times in the length of the head and equals the width of the interorbital space; the groove for the precesses of the intermaxillaries is naked and extends to the vertical through the anterior third of the eye; the free portion of the tail is longer than high; the least height of tail equals the length of the 6th dorsal spine; the 3rd dorsal spine is the longest, its length being contained twice in the height of the body and equals the length of the head without the postorbital portion; the last dorsal spine equals in length the 2d anal, and about equals the length of the snout, and is about as long as the 3d; the first dorsal ray is fully 13 times as long as the 1st dorsal spine; the 2d anal spine is stronger and shorter than the 3rd, its length being contained 32 in the length of the head; the 3d anal spine is contained 34 times in the length of the head; the caudal is forked, its length slightly less than the length of the head, and very little greater than the length of the pectoral; the pectoral reaches to the perpendicular through the origin of the soft dorsal. The ventral is half as long as the head; the vent is under the 2d ray of the soft dorsal. D. IX, 10; A. III, 7; P. 15; V. I, 5; C. + 17 +. L. lat. 44; L. trans.  $\frac{5}{10}$ . The back has a slight tawny hue, interrupted as it blends with the white of the sides by five or six indistinct scollopy incursions of the body color, giving the upper part of the side of the fish a marbled appearance." (Goode & Bean.) West coast of Florida.

(Eucinostomus harengulus Goode & Bean, Proc. U. S. Nat. Mus. 1879, 132, 340.)

# Family XCHL—EMBIOTOCIDÆ.

(The Surf-fishes.)

Viviparous Labroids. Body ovate or oblong, compressed, covered with cycloid scales of moderate size. Cheeks, operculum, and interoperculum scaly. Lateral line continuous, running high, without abrupt flexure: not extending on the caudal fin. Head rather short. Mouth small. terminal. Jaws with conical or compressed teeth of moderate or small size, in one or two series. No teeth on vomer or palatines: no canines: lower pharyngeals united, without suture, their teeth conical or paved. Upper jaw freely protractile. Lips full, the lower either forming a free border to the jaw or else attached by a frenum at the symphysis. Maxillary short, without supplemental bone, slipping for most or all of its length under the preorbital. Opercular bones entire. Branchiostegals 6 (or 5). Gill-rakers usually slender; gill-openings wide, the membranes free from the isthmus or very slightly connected; pseudobranchiæ present; gills 4, a slit behind the fourth. Nostrils round, 2 on each side. Dorsal fin single, long, with 8-18 usually slender spines, which are depressible in a groove. A sheath of scales along the base of the anterior part of soft dorsal and posterior part of spinous dorsal; this sheath separated by a furrow from the scales of the body. Anal fin clongate. with 3 moderate or small spines and 15-35 slender soft rays, its form and structure differing in the two sexes. Ventral fins thoracic, I, 5. Pectorals moderate. Candal forked. Oviduct opening behind the vent, the two apertures always distinctly separated. Air-bladder large, simple. No pyloric coca. Vertebrae 13-19 + 19-23.

Viviparous. The young are hatched within the body, where they remain closely packed in a sac-like enlargement of the oviduct analogous to the uterus, until born. These feetal fishes bear at first little resemblance to the parent, being closely compressed and having the vertical fins exceedingly elevated. At birth they are from 1½ to 2½ inches in length, and similar to the adult in appearance, but more compressed, and red in color. Since the announcement of their viviparous

nature by Dr. Gibbons and Professor Agassiz, in 1853, these fishes have been the subject of much interest to anatomists.

Fishes of the Pacific coast of North America, inhabiting bays and the surf on sandy beaches. One species (*Hysterocarpus traski*) inhabits fresh waters, one ("*Ditrema" violaceum*) is found in Australia, and another (*Ditrema temmincki*) is found in Japan. The species reach a length of from 6 to 18 inches, and are very abundant where found. They are much used for food, but the flesh is poor and tasteless. Most of them feed on crustacea, but one genus (*Abeona*) is partly or wholly herbivorous. Genera 8; species 20.

(Embiotocida: Giinther, iv, 244-251.)

- \* Spinous dorsal longer than the soft part, of 16-18 spines; second anal spine the largest. (Hysterocarpina.)
  - a. Seales large; teeth moderate, conical, in one series; lower lip without frenum.
     HYSTEROGARPUS, 307.
- \*\* Spinous dorsal shorter than the soft part, of 8-11 spines; anal spines graduated. (Embiotocing.)
  - b. Scales large (40-50 in the lateral line); soft dorsal and anal more or less short-
  - bb. Scales small (60-75 in the lateral line).
    - - e. Lower pharyngeal bone normal (with the posterior margin concave, the the lateral horns well developed, and the teeth all on the same plane, some conical, some truncate).
        - f. Lower lip with a frennm, its edge entire.
          - q. Abdomen much longer than the base of the short anal fin.

Hypsurus, 311.

gg. Abdomen much shorter than the base of the long anal fin.

DITREMA. 312.

#### 307.—HYSTEROCARPUS Gibbons.

(Gibbons, Daily Placer Times and Transcript, May 18, 1854, and in Proc. Acad. Nat. Sci. Phila. 1854, 124: type *Hysterocarpus traski* Gibbons.)

Body ovate, the back strongly elevated and convex; head small, the snout projecting; mouth small, with one series of rather large, bluntly conical teeth; the jaws about equal; lips not much enlarged, the lower forming a free border, without frenum; gill-rakers moderate, widely set; branchiostegals 5; scales rather large, silvery; spinous dorsal very

0.

long, of about 16 spines, highest at the fifth or sixth, thence gradually shortened each way, the last spines being shorter than the soft rays; anal spines stronger than in the other genera, curved, the second spine being longer and stronger than the first and third, which are nearly equal; soft rays of anal 20–23 in number, the anterior simply articulated. Fresh waters of California. ( $\delta \sigma \tau z \rho \sigma z$ , later;  $z a \rho \tau \sigma z$ , fruit; *i.e.*, fruit borne late; in allusion to the prolonged development of the embryo.)

## 923. H. traski Gibbons.

Males, above dark brown, sides yellowish or olivaceous, with fine black dots; throat and belly golden yellow; females olivaceous, darker above, with black blotches on sides in irregular transverse bars. Body oval, compressed; ventral curve less than that of the back; head small, profile from snout to occiput concave; mouth small, oblique, maxillary not reaching orbit; lateral line following the curve of the back; dorsal spines rather high, the fourth to seventh highest; cheeks with 3 rows of large scales. Head 3\(\frac{1}{3}\); depth 2. D. XVI, 11; A. III, 22; Lat. l. 40. Rivers of Central California, locally abundant.

(Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 105, 124; Günther, iv, 251.)

## . 308.—ABEONA Girard.

#### Shiners.

(Girard, Proc. Acad. Nat. Sci. Phila, 1855, 322: type Abeona troubridgii Grd. = Cymatogaster minimus Gibbons.)

Body ovate or oblong, compressed. Head moderate. Month small; the jaws about equal; lips rather thin, the lower with a narrow frenum; teeth in one principal series, besides which are often one or two other teeth, stout, somewhat compressed, and incisor-like; all or most of the teeth three-lobed. Gill-rakers very slender and short. Lower pharyngeals scarcely concave behind; the teeth all large and truncate. Scales large. Dorsal fin short and high; the spines robust; the middle ones highest and rather higher than the soft rays. Anal fin short and deep, with strong spines. Vertebræ (in  $A.\ minima$ ) 14+19. Species of small size; partly or wholly herbivorous, feeding on sea-weeds. Coloration variegated. (A coined name without meaning.)

## 921. A. minima (Gibbons) Gill.

Color greenish above with bluish reflections, thickly dusted with black dots; an irregular longitudinal black band along axis of body, and two vertical dark bars downward from base of dorsal fin on which they appear as blotches; sides often with much light yellow; axil of pectorals black. Body oval, compressed, with thick short caudal peduncle and very short head. Profile moderately depressed above the eyes. Spinons dorsal rapidly rising to the fifth or sixth spine, thence gradually descending; spinons dorsal higher than soft part; cheeks with scales in  $2\frac{1}{2}$  series. Head  $3\frac{1}{4}$ ; depth 2. D. IX, 14; A. III, 16; Lat. l. 45. L. 6 inches. Pacific coast of United States; common; the smallest of the family.

(Cymatogaster minimus Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 125: Abeona trowbridgii Girard, U. S. Pac. R. R. Surv. Fish. x, 186, pl. 34, fig. 6-10: Ditrema minimum Günther, iv, 249.)

### 925. A. aurora Jordan & Gilbert.

Color bluish-black above, becoming lighter on sides and silvery be-Opercles and lower half of sides punctate with black dots and shaded with light orange, the latter more intense on the centres of the scales and forming a diffuse lateral band; a broad grayish streak backwards from pectorals to opposite origin of anal, this streak without orange tint and with the margins of the scales dark by aggregation of black points; young specimens with the bright lateral shade more distinct, and rosy instead of orange; fins marked with more or less blackish, the anal with some vellowish: a conspicuous black triangular blotch in the axil of the pectoral. Body elongate, with a very long and rather thick caudal peduncle. Head transversely very convex above, and with a blunt snont. Mouth small, oblique; maxillary reaching but two-thirds the distance to front of orbit. Spinous dorsal with the fifth to the ninth spines highest, and about equal to the longest soft ray. Caudal forked for nearly half its length. Scales on cheeks in 3 distinct series. 4; depth 23. D. IX, 17; A. III, 20; Lat. l. 45. L. 7 inches. Monterey Bay, California; abundant in rock-pools.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 299.)

## 312.-MICROMETRUS Gibbons.

## Sparadas.

(Cymatoguster and Brachyistius Gill: Metrogaster Agassiz.)

(Gibbons, Proc. Cal. Acad. Nat. Sci. in Daily Placer Times and Transcript, May 30, 1854: type Cymatogaster aggregatus Gibbons.)

Body elliptical, oblong, compressed. Head conic. Month small, oblique, the lower jaw slightly shorter; lips thin, the lower with narrow frenum or none; teeth small, conical, rather numerous, in one series. Gill-rakers moderate, slender. Scales comparatively large. Dorsal

spines rather high, some of the middle ones highest, the posterior not so high as the soft rays; the soft dorsal shortened. Anal moderate, with weak spines. Caudal forked. Pharyngeals normal, the teeth all conic. Vertebra (in M. aggregatus) 15 + 20; in M. frenatus 13 + 21. Species of small size and bright coloration. ( $\mu exporter)$ , small;  $\mu \epsilon \tau \rho u \epsilon$ , measure, i. e., small size.)

a. Lower lip with a fremum. (Brachyistius\* Gill.)

## 926. M. frenatus (Gill) J. & G.

Body elongate, compressed, regularly elliptical, with a slender pointed head and a long caudal pedancle; profile much depressed over the eyes, the snout projecting. Month very small, oblique, maxillary not reaching orbit. Cheeks with two rows of scales. Dorsal spines very long and rather strong, the sixth and seventh the longest and a little longer than the soft rays. Caudal rather deeply forked. Gill-rakers slender, rather long. Color dark olive brown above, each scale with a dark spot at base, followed by a light mark; below bright light copperyred; each scale with a blue spot and dark punctulations; head colored like the body; fins all light reddish. Head  $3\frac{3}{4}$ ; depth 3. D. VIII, 15; A. III, 22; Lat. l. 40. L. 8 inches. Entire Pacific coast of United States; locally very abundant.

(Brachyistius frenatus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 275: Brachyistius frenatus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 304: Ditrema breripinne Günther, iv, 248.)

#### 927. M. rosaccus Jordan & Gilbert.

Body oblong-ovate, deepest at the shoulders; the profile thence to the occiput convex, the occipital and interorbital region considerably depressed; body tapering backwards from the shoulders into a short and slender caudal peduncle. Head small, thick, the snout blunt. Mouth comparatively large, little oblique, the lower jaw included; maxillary slightly passing the vertical from the front of the orbit; premaxillary anteriorly on a level with the inferior margin of the pupil. Eye very large, its diameter about one-thi:d the length of the head; interorbital region very broad. Teeth large, conical, truncate at tip, about  $\frac{12}{8}$ ; none on the sides of the lower jaw. Scales on the cheeks in three series. Spinous dorsal high; the first spine about two-fifths the length of the highest; the sixth to tenth of nearly equal height, and higher than the soft rays. Anal fin with the base oblique, the spines rather strong, and more or less curved. Caudal

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1862, 275: type Brachyistins frenatus Gill.  $(\beta \rho \alpha \chi \dot{\psi} \dot{\gamma}, \text{short}; i \delta \tau \iota \sigma \nu, \text{sail.})$ 

fin narrow, forked for more than half its length, the lobes rather pointed, Pectoral fins small, not reaching to the tips of the ventrals. Color rosered with silvery lustre, darker above; top of head orange; a very distinct chocolate colored spot above the lateral line at the origin of the soft dorsal fin; another smaller one just below the end of the soft dorsal. Fins immaculate, tinged with reddish. Head  $3\frac{1}{3}$ ; depth  $2\frac{1}{2}$ . D. X, 18; A. III, 20; scales 6–50–16. L. 8 inches. San Francisco, Cal., in deep water outside the Golden Gate.

(Cymatogaster rosaceus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 303.)

aa. Lower lip without fremum. (Micrometrus.)

## 928. M. aggregatus Gibbons.—Sparada; "Minnow."

Silvery, back dusky; middle of sides anteriorly with the scales each with a cluster of dark points, these forming a series of longitudinal stripes, which extend to opposite the base of the anal; these stripes are interrupted by 3 vertical light yellow bars, on which are no black specks in the adult. Adult males in spring almost entirely black. Body elongate oval, compressed, heaviest at the front of the dorsal; candal peduncle short and slender; head short; teeth very small, conical 12–6; dorsal spines high and rather feeble, rising rapidly to the fifth, thence slowly descending, the last lower than the soft rays. Cheeks with 3 rows of scales. Head  $3\frac{1}{3}$ ; depth  $2\frac{2}{3}$ . D. IX, 20; A. HI, 23; scales 3–38–11. L. 6 inches. Pacific coast of the United States, everywhere exceedingly abundant.

(Cymatogaster aggregatus Gibbons, l. c. May 18, 1854; Gibbons l. c. May 30, 1854; Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 125: Cymatogaster aggregatus Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 106: Holeonotus rhodoterus Girard, U. S. Pac. R. R. Surv. Fish. 193: Ditrema aggregatum Giinther, iv, 248.)

## 310.—AMPRESTICIUS Agassiz.

## Wall-eyed Perch.

 $(\textit{Holcoi}\ o'us\ Agassiz:\ \textit{Eunic'thys}\ Girard:\ \textit{Cymatogaster*}\ and\ \textit{Hyperprosopon}\ Gibbons:\ \textit{Hypocritichthys}\ Gill.)$ 

(Agassiz, Am. John, Sci. Arts. 1854, 367: type Amphistichus argenteus Agassiz.)

Body ovate or oblong, strongly compressed. Month moderate, oblique or almost vertical, with slender conical teeth in two series in each jaw, the outer series longer; lips thin, the lower with or without frenum. Gill-rakers long or short, slender and stiff. Pharyngeals normal. Fins

<sup>\*</sup> The genus Cymatogaster Gibbons, as first defined by its author, is equivalent to the earlier Holeonotus of Agassiz. Prior to this, the name Cymatogaster was used by Gibbons, without explanation, as the generic name of the group afterwards called by him Micrometrus.

not very high, the spines slender. Scales small, 60–75 in the course of the lateral line. Species 5, differing considerably in form and appearance, but agreeing in essential characters. ( $a\mu\psi\iota$ , double;  $\sigma\tau\iota \mu\sigma$ , series.)

- a. Profile depressed or concave over the eyes; mouth very oblique, the lower jaw projecting; eye very large.
  - b. Anal fin short, its rays about III, 23. (Hypocritical thus\* Gill.)

## 929. A. analis (A. Agassiz,) Jor. & Gilb.

Silvery; an inky blotch on the middle of the anal fin and a fainter blotch on the spinous dorsal; front of anal yellow; fins otherwise plain. Axil black. Body comparatively elongate, formed much as in *Micrometrus frenatus*; upper anterior profile nearly straight, depressed above the eyes. Snout sharp. Mouth large, very oblique, the tip of the lower jaw on a line with the upper profile of the snout; maxillary reaching front of orbit. Dorsal spines high and slender, longer than the soft rays, the middle longest. Anal spines small. Caudal fin short, not widely forked; pectorals short and broad, four-fifths the length of head. Eye, five fourths the length of snout. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ . D. IX, 22; A. III, 23; Lat. l. 63. L. 6 inches. San Francisco to Point Concepcion; rather rare; locally abundant at Santa Cruz.

(Hyperprosopou analis Alex. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 133: Hypocritichthys analis Gill, Proc. Acad. Nat. Sci. Phila. 1862, 276: Ditrema anale Günther, iv, 250.)

b. Anal fin long, its rays about III, 33. (Hyperprosopon+Gibbons.)

e. Ventral fins posteriorly black.

## 930. A. arcuatus (Gibbons) J. & G.-Wall-cyel Perch: White Perch.

Bluish black above; sides bright silvery, sometimes faintly barred; ventrals with a broad terminal bar of black; caudal and anal edged with blackish. Body ovate, strongly compressed. Interorbital space rather wide, abruptly depressed at the nape, the profile of the snout extending forward at a less angle than that of the back. Snout very short, much shorter than the eye. Maxillary scarcely reaching front of pupil. Mouth extremely oblique. Eye  $2\frac{1}{2}$  in head, larger than in any other species. Middle dorsal spines a little higher than the last, or than the soft rays; anal low. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{8}$ . D. IX, 27; A.

<sup>\*</sup> Lower lip without frenum; gill-rakers numerous, long.

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1862, 276: type Hyperprosopon analis A. Ag.  $(i\pi o\kappa\rho\iota\tau\sigma\varsigma,$  deceiver;  $i\chi\theta\dot{\nu}\sigma,$  fish; its appearance (Micrometrus) belying its affinities (Holeonotus).

<sup>†</sup>Gibbons, Daily Placer Times and Transcript, May 18, and in Proc. Acad. Nat. Sci. Phila. 1854, 105: type Hyperprosopou argenteus Gibbons. (ὑπηρ, above; πρόσωπον, face.)

III, 32; Lat. l. 72. L. 10 inches. Coast of California, from Cape Mendocino southward; very abundant.

(Hyperprosopon argenteum Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 105: Hyperprosopon argenteum Gibbons, l. c. 125: Hyperprosopon argenteus and arenatus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 273: Ditrema arenatum and Ditrema megalops Günther, iv, 249: Ennichthys megalops Girard, U. S. Pacific R. R. Surv. Fish. 197.)

cc. Ventral fins not black.

## 931. A. agassizi (Gill) J. & G.

Greenish olive above; sides bright silvery; 5 or 6 short blackish vertical bars on the sides, these sometimes obsolete; a dusky patch above anal and on the front part of anal fin; caudal reddish, dusky at tip; ventrals colorless. Body elliptic ovate, the profile nearly straight from the snout to above the occiput, there forming a slight angle, thence straightish to the base of dorsal; ventral outline variable, sometimes strongly arched. Mouth small, very oblique, the premaxillary on the level of the middle of the pupil, the maxillary scarcely reaching front of pupil. Eye half longer than the snout. Three rows of scales on check. Sixth dorsal spine highest, higher than the soft rays; pectorals falcate. D. IX, 25; A. III, 29; Lat. l. 60. L. 8 inches. Coast of California; not generally abundant.

(Hyperprosopon arcuatus Alex. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 125 (not of Gibbons): Hyperprosopon agassizii Gill, Proc. Acad. Nat. Sci. Phila. 1862, 276.)

aa. Profile little depressed above the eyes; month less oblique, the lower jaw not projecting; eye scarcely longer than snout. (Holconotus.\*)

### 932. A. rhodoterus (Agassiz) J. & G.

Greenish above; sides silvery, profusely covered with spots and blotches of light orange-brown or coppery red, these mostly in the form of interrupted vertical bars; candal, anal, and ventral fins bright reddish, without black spots or markings. Body deeper, more elevated, and less compressed than in the preceding species. Profile nearly straight from snout to dorsal. Mouth oblique, forming an angle of about 45 degrees; premaxillary on the level of the lower edge of pupil; maxillary reaching just past front of pupil. Gill-rakers fewer and stouter than in the preceding species. Head  $3\frac{3}{4}$ ; depth 2. D. IX or X, 26; A. III, 29; Lat. l. 65. L. 1 foot. Coast of California; not very abundant.

(Holconotus rhodoterus L. Agassiz, Amer. Jonrn. Sei. Arts, 1854, 368: Holconotus rhodoterus Λ. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 132: Ennichthys heermanni Girard, U. S. Pac. R. R. Sarv. Fish. 199: Ditrema rhodoterum Giinther, iv, 250.)

aa. Lower lip with a frenum; gill-rakers few, short. (Amphistichus.)

<sup>&</sup>quot;Agassiz, Amer. Jour. Sci. Arts, 1854, 367: type Holconotus rhodoterus. (ολπος, furrow; νῶτος, back.)

# 933. A. argenteus Agassiz.—Surf-fish.

Silvery; sides with narrow vertical bars of a brassy olive color, alternating with vertical series of spots of similar color; fins plain; vertical fins sometimes edged with dusky. Month comparatively large, little oblique, the premaxillary being below the level of the rather small eye. Body ovate, the back elevated; ventral outline straightish. Head blunt and deep. Lips rather thin, the lower with a frenum. Gill-rakers few, rather short, stiff; lower pharyngeals normal. Caudal pedunele short and stout. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{4}$ . D. X,  $24\frac{1}{7}$  A. III, 26; Lat. l. 65. Vertebræ 13+18. L. 1 toot. Coast of California; very abundant.

(L. Agassiz, Amer. Journ. Sci. Arts, 1854, 367; Girard, U. S. Pac. R. R. Surv. Fish. 201: Ditrema argenteum Günther, iv, 251: Amphistichus similis Girard, U. S. Pac. R. R. Surv. Fish. 203.)

## 311.-HYPSURUS A. Agassiz.

(Alex. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 133 (nomen nudum): type Embiotocae caryi L. Agassiz.)

Body oblong, compressed, moderately elevated, tapering abruptly to a very slender and short candal peduncle. Head moderate, rather acute, lower jaw included. Lips moderate, the lower with a frenum. Teeth few, conical, blunt, in one series, those of the upper jaw sometimes partly in 2 series. Gill-rakers slender, rather short. Pharyngeals normal. Dorsal fin rather low, the spines all lower than the soft rays. Caudal broad and short, widely forked. Anal fin extremely short, although many rayed, beginning far back, the length of its base being less than half the distance between its first spine and the root of the ventrals, the abdomen being therefore extremely long. Scales rather small. Vertebræ 17 + 20. This genus is distinguished from Ditrema chiefly by the great length of the abdominal region. Species of small size and brilliant coloration. ( $\delta \psi e$ , high;  $\delta \psi \rho a$ , tail.)

## 934. II. caryi (Louis Agassiz) Alexander Agassiz.—Bugara.

Coloration extremely variegated, olivaceous, with stripes of orange between the rows of scales; about 13 dusky orange cross-bars, irregular in form; eyes reddish, surrounded by a sky-blue band; membranes of opercles chiefly orange; opercle bluish, spotted with orange; sides of head with sky-blue spots; lower jaw with orange and blue stripes; breast and belly with longitudinal stripes of bright orange, alternating with steel-blue; abdominal furrow orange, edged with blue; pectoral with an orange crescent at base bordered with light blue; soft dorsal

Bull. Nat. Mus. No. 16-38

with a black blotch near the front; caudal of a peculiar rich orange-brown, with cross-bars formed of round grayish spots; anal chiefly orange tipped with blue, and with a large blackish blotch; other fins orange-brown, mottled. Body elliptical, compressed, the ventral outline comparatively straight. Snout sharp; premaxillaries on the level of the lower margin of pupil. Fourth to sixth dorsal spines highest; higher than the soft rays. Pectoral long. Anal very short; its rays slender and crowded; its origin opposite posterior third of dorsal. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ . D. X, 23; A. III, 24; Lat. l. 71. L. 10 inches. Coast of California; very common from Santa Barbara to San Francisco; a beautiful fish, largely used for bait.

(Embiotoca caryi Agassiz, Amer. Journ. Sei. Arts, 1853, 389, and 1854, 366: Ditrema paryi Günther, iv, 247.)

## 312.-DITREMA Schlegel.

# Surf-fishes.

(Embiotoca Agassiz: Phanerodon Girard: Teniotoca Alex. Agassiz.)

(Schlegel, Fauna Japon. Poiss. 77, 1850: type Ditrema temmineki Bleeker, from Japan.)

Body oblong, compressed, more or less elevated, with the caudal peduncle robust or rather slender. Head moderate, lower jaw included. Lips moderate, the lower with a frenum. Maxillary short, its whole length slipping under the preorbital. Teeth few, conical, bluntish, in one series. Gill-rakers weak, rather short and slender. Pharyngeals normal. Caudal fin lunate or forked; anal fin rather long, much longer than abdomen, its spines small. Scales small, about 60 in the lateral line. Species 5, differing in external appearance, but alike in essential characters. The Japanese type of this genus is closely related to Ditrema atripes. (¿io, two; τρῦμα, aperture.)

a. Caudal peduncle stout, the fin not widely forked. (Embiotoca \* Agassiz.)

# 935. D. laterale (Agassiz) Gthr.—Blue Perch; Surf-fish.

Color reddish olive above, becoming bright orange red below, everywhere thickly dusted with black points; a continuous bright blue streak along the edges of each row of scales; streaks of thoracic region formed by isolated blue spots on the middle of the scales; head with several series of blue spots and streaks; fins all olivaceous dusky; ventrals with some light orange. Body oblong, compressed, with a short and very high caudal peduncle, the body tapering backward less than usual.

<sup>\*</sup> Agassiz, Amer. Journ. Sci. Arts, 1853, 387: type Embiotoca jacksoni Ag. (εμβιος, life within; τόκος, offspring.)

Mouth but little oblique, the maxillary scarcely reaching orbit. Teeth strong. Spinons dorsal very low, the last spine highest, but much shorter than the soft rays; soft dorsal and anal high. D. X or XI, 23; A. III, 31; Lat. 1. 63; Vert. 15 + 19. L. 15 inches. Pacific coast of the United States; everywhere very abundant.

(Embiotoca lateralis Agassiz, Amer. Journ. Sci. Arts, 1854, 366; Taniotoca lateralis Alex. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 133; Embiotoca lineata, ornata, and perspicabilis Girard, U. S. Pac. R. R. Surv. Fish.; Günther, iv, 245.)

# 936. D. jacksoni (Agassiz) Günther. - Surf-fish; Croaker; Black Perch.

Brownish, tinged with green, blue, red, or yellowish; sides with about 10 faint vertical dusky bars; belly usually yellowish; head with blue spots; fins dusky, tinged with blue or red; anal in males sometimes red with a black patch, and the ventrals orange. Colors extremely variable, the pattern of color not definite. Form ovate, rather thick, the outlines convex. Mouth rather small. Dorsal spines low, much lower than the soft rays; caudal peduncle thickish, the fin not widely forked. Scales on cheeks in 4 series. Head 34; depth 2. D. IX or X, 20; A. III, 25; Lat. 1. 58. L. 1 foot. Pacific coast of the United States; the most abundant of the larger species southward.

(Embiotoca jacksoni Agassiz, Amer. Journ. Sci. Arts, 1853, 387, and 1854, 366: Embiotoca jacksoni Girard, U. S. Pac. R. R. Surv. Fish. 168; Günther, iv, 245: Embiotoca cassidii and E. webbi Girard, U. S. Pac. R. R. Surv. Fish. 171, 173.)

aa. Caudal peduncle slender, the fin widely forked. (Phanerodon Girard.\*)

b. Ventral fins blackish at tip.

### 937. D. atripes Jordan & Gilbert.

Light olivaceous above, pearly below; scales above the axis of body each with an orange spot at base, its outer margin tinged with blue, these forming faint reddish streaks along the rows of scales; anal with a dusky spot; ventrals broadly tipped with blackish; caudal not darkedged. Body elongate, tapering into a long and slender caudal peduncle. Snout rather projecting. Head small. Mouth small, the maxillary not extending to opposite the eye. Teeth few and small. Eye as long as snout,  $3\frac{1}{2}$  in head. Cheeks with 3 rows of scales. Gill-rakers longer than in related species, and pharyngeals stronger, with the teeth more nearly paved. Highest dorsal spine shorter than the soft rays. Pectorals long, reaching tip of ventrals. Caudal lobes equal. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ . D. X, 23; A. III, 29; Lat. 1. 70. L. 10 inches. Monterey Bay; locally abundant.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 320.)

#### bb. Ventral fins colorless.

<sup>\*</sup> Girard, Proc. Acad. Nat. Sci. Phila. 1854, 153: type Phanerodon furcatus Grd. (φανερος, visible; οδων, tooth.)

## 938. D. furcatum (Grd.) Günther.

Light olivaceous, silvery below, sometimes yellowish; scales with bright reflections, but no red markings; usually a round dusky spot on the anal; ventrals plain; caudal fin edged behind with dusky; fins usually yellowish tinged. Body oblong-elliptical, compressed, tapering backward into the long and slender caudal peduncle; mouth small; teeth rather large, conical; gill-rakers very short and slender; last dorsal spine highest, sometimes higher than the soft rays, the fin higher than in *D. atripes*; caudal fin strongly forked, the upper lobe usually the longer. Head  $3\frac{3}{4}$ ; depth  $2\frac{1}{2}$ ; D. X, 24; A. III, 32; Lat. l. 66. L. 1 foot. Coast of California; extremely abundant from Cape Mendocino southward.

(Phanerodon furcatus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 163, and in U. S. Pac. R. R. Surv. Fish. 184; Günther, iv. 247.)

## 313.—RHACOCHILUS Agassiz.

(Agassiz, Am. Journ. Sci. Arts 1854, 367: type Rhacochilus toxotes Agassiz.)

Body ovate, compressed, tapering abruptly into a long and robust caudal peduncle; mouth comparatively large, the lower jaw included; lips extremely thick, the lower without frenum, its posterior free edge coarsely lobed; teeth few, small, conical, in one series; gill-rakers rather long; pharyngeals normal; scales small; dorsal spines low, posteriorly subequal, much shorter than the soft rays; caudal deeply forked; anal basis elongate, the spines small. Vertebræ 14 + 22. The genus differs from Ditrema chiefly in the development of the lips.  $(\hat{\rho}\acute{a}z\sigma_5, \text{ragged}; \chi z \tilde{\epsilon} i \lambda \sigma_5, \text{lip.})$ 

## 939. R. toxotes Agassiz .- Alfione.

Olivaceous, with brassy reflections and dusky points; fins plain; body ovate, with elevated back and long, thick candal pedunele; head deep, with prominent snout; mouth wide, oblique; maxillary reaching front of orbit, slipping under the preorbital; lips extremely large, with uneven surface; teeth strong, wide set, those in mandible little developed; eye large. Soft dorsal considerably elevated, much higher than spinous portion; pectorals and ventrals long; caudal short, deeply forked, the upper lobe the longer. Head  $3\frac{2}{5}$ ; depth  $2\frac{2}{5}$ . D. X, 23; A. III, 30; Lat. 1. 76. L. 18 inches. The largest and least handsome of the family, and the one of most value as food. Coast of California; rather-common.

(Agassiz, Am. Journ. Sci. Arts, 1854, 367; Girard, U. S. Pac. R. R. Surv. Fish. 188: Ditrema toxotes Günther, iv, 247.)

# 314.-DAMALICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1855, 321: type Damalichthys racca Girard.)

Body ovate, compressed, with long caudal peduncle. Head rather large. Mouth moderate, the lower jaw included. Lips full, the lower with a frenum. Teeth very few, short, conical, bluntish, in one series. Gill-rakers short and slender. Lower pharyngeal very large, convex behind in outline, with the lateral horns very short and thick. Anterior tooth-bearing area on the plane of the bone; posterior area inclined backward, forming a steep angle with the anterior part; teeth on anterior part low, truncate, hexagonal, tessell ited; on posterior part ovate, flattened, imbricated, and turned forward so that the posterior side forms the grinding edge. Scales rather small. Dorsal spines low, much shorter than the soft rays. Anal fin long, with small spines. Vertebrae 13 + 21. Species of large size, plainly colored, externally resembling Ditrema, but singularly distinguished from all the other members of the family by the peculiar pharyngeals. ( $\delta \dot{a} \mu a \lambda \dot{t} z$ , calf;  $iz \theta \dot{b} z$ , fish; in allusion to its viviparity.)

# 949. D. argyrosomus (Girard) J. & G.—White Perch; Porgee.

Color soiled white, with silvery lustre; three or four obscure dusky bars, most distinct in the young; fins nearly plain, dusky. Form broadly elliptical, the dorsal curve regular; caudal peduncle rather slender. Head not blunt; premaxillary just below the level of the pupil, the maxillary scarcely reaching front of eye. Lips thickish, even. Cheeks with 3 or 4 rows of scales. Gill-rakers not  $\frac{1}{4}$  so long as the large eye, which is longer than snout. Teeth very few, short and blunt. Dorsal spines stoutish, the last one highest, half the height of the soft rays. Caudal deeply forked, the upper lobe the longer. Pectoral long. Head  $3\frac{1}{3}$ ; depth  $2\frac{1}{3}$ . D. X, 23; A, III, 29; Lat. l. 63. L. 15 inches. Pacific coast of United States, north to Vancouver's Island; very abundant northward.

(Embiotoca aryyrosoma Grd. Proc. Acad. Nat. Sci. Phila. 1855, 136, and in U. S. Pac. R. R. Surv. Fish. 180: Damalichthys vacca Girard, Proc. Acad. Nat. Sci. Phila. 1855, 321, and in U. S. Pac. R. R. Surv. Fish. 182: Ditrema vacca Günther, iv, 246.)

# FAMILY XCIV.—LABRIDÆ.

(The Wrasse-fishes.)

Body oblong or elongate, covered with cycloid scales; lateral line continuous or interrupted, often angularly bent. Mouth moderate,

terminal: premaxillaries protractile: maxillaries without supplemental bone, slipping under the membranaceous edge of preorbital: the anterior teeth in the jaws usually very strong; teeth of the jaws separate or more or less soldered together, sometimes forming a continuous plate: no teeth on vomer or palatines: lower pharvngeals completely united into one bone, without median suture. Lips thick, longitudinally plicate. Nostrils round, with two openings on each side. Dorsal fin continuous, the spinous portion long: anal similar to soft dorsal, usually with two or three spines. Ventrals thoracic, I. 5. Branchiostegals Pseudobranchiæ present. Gills 31: the slit behind the last arch small or obsolete: the gill-membranes somewhat connected, often joined to the narrow isthmus. Air-bladder present. No pylorie cœca. Genera 65, species 450, chiefly of the tropical seas. Many of them are brilliantly colored, and some are valued as food-fish. Most of them feed upon mollusks, the dentition being adapted for crushing shells. The group has been much subdivided, and many of the current genera are distinguished by characters of little importance.

(Labridæ Günther, iv, 65-244.)

- a. Teeth in jaws distinct; pharyngeal teeth not confluent; anal spines 3.
  - b. Dorsal fin with 15-20 spines; teeth all conical; no posterior canines; lateral line continuous. (Labrina.)

    - cc. Preopercle entire; cheeks scaly; opercles naked; teeth in about two series.

ccc. Preopercle entire; cheeks and opercles scaly; teeth in a single series.

LACHNOLÆMUS, 317.

- bb. Dorsal fin with 8-13 spines. (Julidina.)
  - d. Lateral line continuous.
    - e. Checks and opercles scaly; dorsal spines 12; posterior canines present.

HARPE, 318.

- ee. Cheeks and opercles naked or very nearly so; dorsal spines 9.
- dd. Lateral line interrupted; head naked, its upper edge usually trenchant.
  - Хупситнуз, 321.
- aa. Teeth in jaws confluent; pharyngeal teeth pavement-like; anal spines 2; scales large. (Scarina.)
  - g. Teeth partly separate, the anterior distinct; dorsal spines flexible.

Calliodon, 322.

#### 315 - CTENOLARRUS Cuvier & Valenciennes.

#### Cunners.

(Cuv. et Val. Hist. Nat. Poiss, xiii, 223, 1839; type Labrus rupestris L. of Europe.)

Body oblong, not elevated, comparatively slender and compressed. Head moderate, more or less pointed. Teeth in the jaws in several series, the outermost very strong; the teeth unequal, conical, and pointed; no posterior canines. Cheeks with small scales; opercles with large ones. Preopercle with the vertical limb finely serrated. Branchiostegals 5. Gill-membranes considerably united, free from the isthmus; gill-rakers short. Scales moderate, 35–50 in the lateral line; lateral line continuous, abruptly bent opposite posterior part of second dorsal. Dorsal long and low, the spinous portion much longer than the soft, of 16–18 low, subequal, rather strong spines; soft dorsal slightly elevated; anal fin similar to soft dorsal, with three strong graduated spines; candal truncate; pectorals short, the ventrals inserted behind their axils. (x7217, x72167, a comb; Labrus, a related genus, from the Latin labrum, lip.)

a: Interopercle naked. (Tautogolabrus Günther.\*)

# 941. C. adspersus (Walb.) Goode.—Cunner; Chogset; Blue Perch.

Brownish blue, with more or less of a brassy lustre; colors variable; young variegated and with a black blotch on the dorsal fin. Eye moderate, broader than preorbital,  $4\frac{1}{2}$  in head. Head  $3\frac{1}{2}$  in length; depth 3. D. XVIII, 10; A. III, 9; Lat. l. 45. L. 12 inches. Newfoundland to Cape Hatteras; common northward, about rocks.

(Labrus adspersus Walbanm, Artedi, Pisc. 1792, 254: Ctenolabrus burgall Günther, iv, 90: Ctenolabrus caruleus Storer, Hist. Fish Mass. 234.)

#### 316 .- TAUTOGA Mitchill.

# Tautogs.

(Mitchill, Report Fish New York, 1814, 23: type Labrus tantoga Mitchill = Tantoga nigra Mitchill = Labrus onitis L.)

Body oblong, not elevated nor greatly compressed. Head large, nearly as deep as long, with a convex profile. Mouth rather small. Teeth very strong, conical, in two series; the outer somewhat incisorlike; the two anterior teeth in each jaw strong; the posterior teeth small, without canines. Eye small, high up. Cheeks with small scales.

<sup>\*</sup>Günther, Cat. Fish. Brit. Mus. iv, 90: type Labrus burgall Bloch and Schneider: [Tautoga; Labrus.]

Opercles naked, except above. Scales on body rather small, in about 60 transverse series, those on ventral region reduced in size. Lateral line continuous, abruptly decurved opposite the end of the soft dorsal. Dorsal fin long, low, continuous, the spinous part much the longer, with about 16 low, strong, subequal spines, each with a small cutaneous appendage at tip; soft dorsal higher than spinous; anal similar to soft dorsal, with three stout, graduated spines; pectorals broad and rather short; caudal short, truncate, with rounded angles; the soft parts of the vertical fins with the membranes somewhat scaly; ventrals conspicuously behind pectorals. Branchiostegals 5. Gill-rakers very short and feeble; gill-membranes somewhat connected, free from the isthmus. A single species known. (A latinization of the vernacular name "Tautog," which is of Indian origin.)

942. T. onitis (L.) Gthr.—Tautog; Black-fish; Oyster-fish.

Blackish; young greenish, with about three pairs of irregular chain-like bars, the sides sometimes reticulated; chin white. Pectorals short, rounded, not reaching the tips of the short ventrals. Head 3½ in length; depth 3. D. XVI, 10; A. III, 8; Lat. l. 60. Maine to South Carolina; a common food-fish.

(Labrus onitis Linn. Syst. Nat.; Günther, iv, 88: Tautoga americana Storer, Hist. Fish. Mass. 276.)

#### 317.-LACHNOLÆMUS Cavier & Valenciennes.

# Hog-fishes.

(Cuv. & Val. Hist. Nat. Poiss. xiii, 274, 1839: type Lachnolomus aigula C. & V. = Labrus falcatus L.)

Body strongly compressed, the back sharp and elevated, the profile long and steep. Snout sharp. Mouth low, horizontal, the jaws narrow; premaxillary slipping under the membranaceous edge of the very broad preorbital, which is twice the depth of the eye. Teeth in front prominent, canine-like, in a single series; no posterior canines. Cheeks and opercles with imbricate scales. Scales of moderate size, thin, adherent. Lateral line complete. Dorsal with fourteen spines, the first three strong, falcate, produced in long streamers in the adult, the membranes between these spines very low, the filamentous tips longer than the head; other spines all low, gradually shorter to the eleventh; second dorsal and anal much produced; caudal lobes falcate; third anal spine strong; pectorals and ventrals short. One species known. (λάγνη, velvety; λαιμός, throat, the pharyngeal bones being only partly provided with teeth, and the rest of their surface covered with a velvety membrane.)

## 943. L. falcatus (L.) C. & V.—Hog-fish; Aigrette; Capitaine.

Chiefly red; a jet black spot usually present at base of soft dorsal; ventrals dusky; cheeks with 4 rows of scales. Ventrals reaching beyond tips of pectorals. Head 3; depth 2¼; scales 8-40-19; vert. 12 + 17. L. 14 inches. West Indies, north to Florida; abundant. An excellent food-fish; varies much with age.

(Labrus falcatus L. Syst. Nat. i, 475: Lachnolomus falcatus, aigula, dux, suillus, caninus, and psittueus C. & V. xiii, 277-291; Günther, iv, 87; Goode, Bull. U. S. Nat. Mus. v, 36, 1876.)

## 318.-HARPE Lacépède.

## Lady-fishes.

(Cossyphus Cuv. & Val.; preoccupied: Trochocopus Günther: Pimelometopon Gill.)

(Lacépède, Hist. Nat. Poiss, iv, 426, 1802: type Harpe cæruleo-aureus Lac. = Labrus rufus L.)

Body oblong, moderately compressed, covered with firm scales of varying size, 25 to 60 in the course of the lateral line, which is continuous, Head rather pointed in the young, becoming very deep and convex in the adult from the development of the adipose tissue on the top of the head. Operele, suboperele, interoperele, and cheeks scaly, preoperele naked; preopercle minutely serrulate or entire. Jaws each with four strong, conical, somewhat compressed canines in front, the lateral teeth similar, but much smaller, coalescent at base with each other, and with small granular teeth, so that the surface of the jaws is bony; upper iaw with strong posterior canines, directed forwards. Dorsal fin with about twelve low spines, its soft portion scaly at base or naked; anal with three spines, the spines rather strong; lobes of soft dorsal, anal and caudal more or less produced in the adult; ventrals inserted directly below pectorals. Gill-membranes slightly connected. Coarse, brightlycolored fishes, inhabiting tropical seas. ( $\tilde{a}\rho\pi\eta$ , seythe; in allusion to the falcate fins.)

 $a. \ \ \text{Base of dorsal scaly; scales rather large; vertical fins with falcate lobes.} \ \ (\textit{Harpe.})$ 

## 944. H. rufa (L.) Gill.—Lady-fish; Doncella.

Head and upper half of body anteriorly rich chestnut brown; remainder, including lower half of operculum, bright golden yellow. Snout pointed, its length more than one-third that of the head. Head longer than high. Upper lip thick, with conspicuous folds; preoperculum denticulate. Two onter ventral rays and lobes of soft dorsal, anal and caudal much produced; the long rays of the dorsal and anal extending to the middle of the median caudal rays, the outer caudal

rays twice as long as the median. (Goode.) D. XII, 10; A. III, 11; scales 5-32-13. West Indies, north to Florida Keys.

(Labrus rufus L. Syst. Nat. i, 284: Cossyphus rufus Günther, iv, 108; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 222; Goode, Bull. U. S. Nat. Mus. v, 37: Cossyphus bodianus Cuv. & Val. xii, 103: Bodianus rufus Poey, Rep. Fis. Nat. Cuba, ii, 331.)

aa. Base of dorsal not scaly; scales rather small; vertical fins little produced. (Pime-lowetopon\* Gill.)

## 945. H. pulchra (Ayres) J. & G.—Red-fish; Fat-head.

Males with the head, dorsal, anal, and caudal fins, and the posterior part of the body, as far as the vent, purplish black; middle part of the body, pectoral fin, middle of caudal, and posterior edge of dorsal red, varying in tint from clear crimson to blackish, with coppery or purplish lustre; region about shoulder-girdle reddest; lower jaw in both sexes abruptly and entirely white; females dusky rose-colored, with the black areas ill defined or obsolete. Forehead in the adult with a very prominent fatty hump. Gill-rakers short, thickish. Caudal fin truncate, the lobes in the adult produced and pointed. Scales on breast small; preopercle serrulate in young. Head  $3\frac{1}{3}$ ; depth 3. D. XII, 10; A. III, 12; Lat. 1. 62. L. 30 inches. Coast of California, from Point Concepcion southwards; very abundant. Dried in immense numbers by the Chinese.

(Labrus pulcher Ayres, Proc. Cal. Acad. Nat. Sci. i, 3, 1854: Semicossyphus pulcher Günther, iv, 99; Pimelometopon pulcher Gill, Proc. Acad. Nat. Sci. Phila. 1864, 59.)

#### 319.-PLATYGLOSSUS Bleeker.

#### Doncellas.

(Halichares Ruppell, preoccupied: Charojulis Gill.)

(Klein; Bleeker, Proc. Zoöl. Soc. Lond. 1861, 411: type Julis annularis C. & V.)

Body oblong, compressed, not elevated, covered with large scales, there being 25–30 in the course of the lateral line, which is not interrupted, but abruptly bent posteriorly. Scales on breast rather smaller. Head naked, compressed, conic. Preopercle entire. Teeth large, each jaw with two to four canines in front, none of them bent backwards; a posterior canine tooth directed forwards on each side of the upper jaw. Dorsal spines nine; anal spines three, gradnated; ventrals inserted under axil of pectoral. Gill-rakers short and feeble; gill-membranes slightly joined to a narrow isthmus. Species numerous, brilliantly colored, abounding in kelp in the tropical seas. ( $\pi \lambda a \tau v \varepsilon$ , broad;  $\gamma \lambda \omega \sigma \sigma a$ , tongue; an old name without evident application.)

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1864, 58: type Labrus pulcher Ayres. (πιμελος, fat; μετοπον, forehead.)

## 946. P. radiatus (L.) J. & G.—Blue-fish; Doncella.

Adult brilliant azure-blue, each scale edged with bright pearly green; a longitudinal blue band on anal; margin of dorsal light blue; young ("eyanostigma") brownish, a light-blue spot on the base of each scale; head with spots and stripes of bright blue; dorsal with 4 lines of stripes and blotches and a broad edge of blue; caudal with a broad white margin, the outer rays blue, the base of the fin spotted with blue; anal with border and two longitudinal stripes of blue, besides a blue spot at the base of each ray; pectoral with first 5 rays and a transverse line blue. Head 4; depth 3. D. IX, 11; A. III, 12; scales 2-28-10. L. 16 inches. West Indies, north to Key West.

(Sparus radiatus Linnieus, Syst. Nat. xii, 472, 1766; Julis cyanostigma, principis, and patatus Cuv. & Val. xiii, 391-398; Platyglossus cyanostigma Günther, iv, 161; Platyglossus principis Günther, iv, 164; Charojulis radiatus Goode, Bull. U. S. Nat. Mus. v, 35.)

## 947. P. grandisquamis (Gill) J. & G.

Color, in spirits, dark chestnut or brownish red; a very dark vertical spot bordered by steel-blue, behind the opercle; anal fin faintly barred; caudal marbled, and with a marginal dark band. Body rather short and stout. Profile slightly convex. Maxillary nearly reaching front of orbit. Dorsal spines short, rather stiff. Caudal fin subtruncated. Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ . D. IX, 11; A. III, 12; Lat. l. 27. Beaufort, N. C.

(Charojulis grandisquamis Gill, Proc. Acad. Nat. Sci. Phila. 1863, 206.)

## 948. P. humeralis (Poey) Gthr

A black spot, edged with pearl color posteriorly, on the extremity of the operculum; a brown band from the snout through the eye and the opercular spot across the bend of the lateral line to the base of the caudal; a second from below the axil along the side of the belly; a bluish streak, edged with darker, from the eye obliquely upward and backward, meeting its fellow on the nape; base of pectoral whitish, without black spot; caudal truncate, with blue angles. A black band along the middle of the dorsal fin is described by Dr. Günther, but is wanting in the specimens seen by us. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ . D. IX, 11; A. III, 11; scales 2–29–10. Coast of Cuba, north to Florida.

(Julis humeralis Poey, Mem. Cuba, ii, 212, 1858; Günther, iv, 165; Chorrojulis humeralis Goode & Bean, Proc. U. S. Nat. Mus. 1879, 338.)

### 949. P. semicinetus (Ayres) Günther.—Kelp-fish.

Dark greenish brown, with bright reflections; head bronze-green above; three or four narrow, horizontal, wavy blue bands below the

eye, alternating with bronze. Just above middle of body, close behind the pectorals, in the males, is a deep indigo-blue cross band, which nearly meets its fellow under the belly. Pectorals yellow, upper edge of axil black; ventrals cream-color, each reaching beyond the posterior edge of the blue cross-band; other fins with horizontal, wavy, reddish streaks; female without blue band, but with irregular ink-like spots on numerous scales on the back and tail. Body oblong, compressed, rather elevated at the nape. Lips thick, the lower with a frenum. Teeth in about two series; three or four of the anterior in each jaw, canine-like. Eye small. Dorsal spines slender, low, and flexible. Scales on breast small. Head 3½; depth 3½. D IX, 12; A. III, 12; Lat. l. 28. Pacific coast, north to Point Concepcion, not rare southward.

(Julis semicinctus Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 32; Günther, iv, 161; Steindachner, Ichthyol. Beiträge, v, 151, 1876.)

#### 320.—PSEUDOJULIS Bleeker.

#### Señoritas.

(Bleeker, Proc. Zoöl. Soc. London, 1861, 412: type Julis girardi Bleeker.)

This genus differs from *Platyglossus* only in the lack of development of the posterior canines, which are either wanting altogether or reduced to a slight rudiment. ( $\varphi \varepsilon \tilde{\nu} \delta \sigma \varepsilon$ , false;  $\omega \nu \lambda \sigma \varepsilon$ , Julis, an allied genus.)

a. Dorsal spines very slender and flexible. (Oxyjulis\* Gill.)

#### 950. P. modestus (Grd.) Gthr.—Señorita; Pesee Rey.

Olive-brown, the scales each with orange-brown in the centre; cream-color below; sides of head with alternating horizontal streaks of bluish and brown; a dark blue spot at base of pectoral above; membrane of base of spinous dorsal largely indigo-blue; a large inky blotch at base of caudal, covering one-third the fin; fins otherwise light brown. Body elongate, the back not elevated, the head slender and sharp. A small posterior canine sometimes present on one side, usually entirely wanting. Fins low; ventrals short; caudal truncate; spines weak and slender; pectorals reaching beyond tips of ventrals. Head 4; depth 4½. D. IX, 13; A. III, 13; Lat. l. 28. L. 7 inches. Pacific coast; abundant southward. A graceful little fish.

(Julis modestus Girard, U. S. Pac. R. R. Surv. Fish. 1858, 163; Günther, iv, 168: Oxyjulis modestus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 142.)

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1862, 142: type Julis modestus Ayres.

### 321 .- XVRICHTHYS Cuvier & Valenciennes.

# Razor-fishes.

(Cuv. & Val. Hist. Nat. Poiss. xiv. 33, 1859: type Coryphana novacula L.)

Body oblong, compressed, deepest behind the occiput, thence tapering backward. Head very short and deep; the profile almost vertical; the upper and anterior outlines compressed to an edge, at least in typical species. Preorbital very deep. Eyes high, near the top of the head. Mouth small, low. No posterior canines. Cheeks and opercles naked, or with only a few very small scales below the eye. Scales large, with membranaceous edges; less than thirty in a longitudinal series; lateral line interrupted behind, commencing again lower down on the caudal peduncle. Dorsal fin continuous, with nine spines. Colors brilliant. Tropical seas.  $(\xi \nu \rho \partial \nu, \text{razor}; i \chi \theta \delta z, \text{ fish.})$ 

## 951. X. vermiculatus Poey.

Head greenish, tinged with orange on the side; seven or eight blue stripes along the cheeks; three on the opercles; body brownish, paler below; each scale with a blue vertical band and sometimes some blue spots; toward the end of the pectoral is a broad violet band on the sides; dorsal and anal carmine red with blue vertical lines, paler on the front of the dorsal; caudal blue, with vermilion bands; pectorals white; ventrals rosy. Head very short, deeper than long, the front compressed, sharp, almost vertical. Preorbital very deep, its depth half the length of the head. Eye small, placed very high, its distance from the profile scarcely greater than its diameter; four small scales below the eye. Two canines in front of each jaw. Dorsal spines low, flexible; ventrals rather long; pectorals short. Head 4; depth 3½. D. IX, 12; A. III, 11; scales 2–27–8. West Indies, north to Key West, Fla.; very similar to the European X. novacula (L.) Cuv. & Val., if not identical with it.

(Poey Memorias Cuba, ii, 215, 1858.)

## 952. X. lineatus Cnv. & Val.—Razor-fish.

Rose-red; a large oblong blotch on each side of the belly, below the pectorals; narrow lines descend from these blotches, meeting on the belly. The two anterior dorsal spines flexible, not produced. Onter ventral ray prolonged, not reaching vent. D. 1X, 12; A. III, 12; Lat. 1. 25. (Günther.) West Indies; occasional on our Southern coasts.

(Cuvier & Valenciennes, xiv, 50, 1839: Noracula lineata Günther, iv, 171.)

#### 322.-CALLIODON Gronow.

(Gronow; Bloch & Schneider, Syst. Ichth. 1801, 312: type Calliodon lineatus Bloch & Schneider.)

Body moderately elongate, compressed, covered with large scales. Lateral line complete, its branching tubes covering the surface of its scales. Teeth at base coalescent with the bony jaw, the tips free; no median division in either jaw; upper jaw with canine-like teeth in front; posterior canines present; lower pharyngeal bone large, broader than long; the teeth coalescing, forming a pavement. One row of large scales on the cheek. Dorsal spines flexible. D. IX, 9 or 10; A. II, 8; scales about 2-24-6. Tropical seas. (zaλòs, beautiful; ἀδὰν, tooth.)

### 953. C. ustus Cuv. & Val.

Reddish in spirits, nearly plain, a black spot behind the first dorsal spine. Body moderately elongated, compressed. Head rather pointed. Upper jaw with 6 canines in front, free at their tips, coalescent below; no smaller teeth behind these; posterior canine well developed, directed outward and partly backward; between the anterior and posterior canines a series of small teeth behind the sharp edge of the bone. Lower jaw with a series of close-set, even, bluntish teeth, coalescing below; upper lip double for its whole length, covering all of the upper jaw except the tips of the teeth. Opercles with two rows of scales, larger than those on the cheeks. Dorsal spines moderately high, very slender; pectoral short, rounded; caudal truncate. D. IX, 9; A. II, 8; scales 1½-24-6. West Indies, occasional northward. This description taken from a specimen obtained at Charleston by Mr. R. E. Earll.

(Cuv. & Val. xiv, 283, 1839; Günther, iv, 214.)

### 323.—HEMISTOMA Swainson.

# Parrot-fishes.

#### Pseudoscarus Bleeker.

(Swainson, Class'n. Anim. ii, 1839, 226: type Scarus pepo Bennett.)

Body oblong, more or less compressed, covered with very large scales. Lateral line continuous. Lower jaw included; teeth in each jaw soldered together, forming a continuous plate, divided by a median suture as in *Tetrodon*; the separate teeth traceable by serrations on the edge and by reticulated markings on the anterior surface; none of them exserted; posterior canines small or wanting; lower pharyngeal very large, longer than broad, the teeth paved. Scales on the cheek in more than one series. Dorsal spines flexible; dorsal IX, 10, or X, 9;

anal II, 8, or 9. About 24 scales in the lateral line. Tropical seas. Large fishes of the tropical seas, brilliantly colored, little valued as food. Many species occur in the West Indies, any of which may be found about the Florida Keys. The closely related genus *Scarus* Forskål, distinguished chiefly by the stiff spines of the dorsal fin, occurs in the same waters, and several of its species may be looked for on our coast. (im, half; \(\sigma\_{\phi}\omega\_{\ell}\alpha\_{\ell}\), mouth; the jaws divided.)

## 954. II. guncamaia (Cuv. & Val.) J. & G.

Brownish, the jaws and naked parts of the head green; fins dark, the margin of the dorsal, anal, and ventrals green. Upper lip thick, covering more than half of the plate of the jaw; lower lip full; no posterior canine teeth. A single scale on the lower limb of the preopercle, besides the two series of scales on the cheek; opercle with two rows of scales; top of head scaled forwards to the eyes. Eye small, about midway in head. Dorsal fin not emarginate; anal spines long and flexible; caudal shortish, double truncate; pectorals short. Lateral line abruptly decurved posteriorly. Head 3; depth 3. D. X, 9; A. II, 9; Lat. 1. 23. West Indies, north to Key West, Fla.

(Scarus guacamaia Cuv. & Val. xiv, 178, 1839: Pseudoscarus guacamaia Günther, iv, 233.)

# FAMILY XCV.—CICHLIDÆ.

(The Cichlids.)

Fresh-water Labroids. Body elevated, oblong or elongate, covered with moderate-sized scales, which are usually ctenoid. Lateral line interrupted, usually ceasing opposite the posterior part of the dorsal, and then recommencing lower down on the caudal peduncle. Month varying in size, terminal, the jaws with rather small teeth, which are usually conical, but sometimes lobate or incisor-like; no teeth on vomer or palatines. Nostril single on each side. Premaxillaries freely protractile; maxillary slipping under the broad preorbital. Gill-rakers various; gillmembranes often connected. Dorsal fin single, with the spinous portion well developed, usually rather longer than the soft portion; anal fin with 3 or more spines, the soft part similar to the soft dorsal; ventral fins thoracic, I, 5. Lower pharyngeal bones united into a triangular piece, with a median suture. Branchiostegals 5 or 6; no pseudobranchiæ. Gills 4; a slit behind the fourth. Air-bladder present. A large family of fresh-water fishes of moderate or small size, representing, as to form, size, appearance, and habits, and even as to many details of structure, in the waters of South America, the Centrarchidæ of the United States. Genera about 25; species about 120, inhabiting the rivers of Africa and tropical America, the genus *Heros* extending into the limits of the United States. Those with lobate teeth are herbivorous, the rest carnivorous.

(Chromides Günther, iv, 264-316.)

#### 324.-HEROS Heckel.

(Herichthys Baird & Girard.)

(Heckel, Brazil, Fluss-fische, Ann. Wien. Mus. ii, 362; 1840: type Heros severus Heckel.) Body oblong, compressed, somewhat elevated, the form Centrarchoid. Head rather large, scaly on the cheeks and opercles; preopercle entire. Mouth rather small, terminal, low, the jaws equal; maxillary small; preorbital deep; jaws with a single series of rather stout conical teeth. behind which, in front, is a narrow band of villiform teeth. Gill-membranes slightly connected, free from the isthmus; gill-rakers short and Scales rather large, ctenoid; the lateral line interrupted and beginning again below, as usual in this family. Dorsal fin continuous, the spinous part much longer than the soft part, of about 17 rather low but strong spines; soft rays much higher than spines; anal fin similar to soft dorsal but shorter, its spinous part also longer than the soft, of about 6 spines; caudal fin subtruncate, with rounded angles. Species very numerous in Central and South America.  $(\eta \rho \omega_5, \text{ hero}; \text{ the appli-}$ cation not evident.)

### 955. H. cyanoguttatus (B. & G.) Gthr.

Brownish, body and soft parts of vertical fins everywhere with small blue spots; sometimes a black spot on middle of spinous dorsal, with another one below it on the back; a black blotch at base of caudal. Body oval, moderately compressed; profile gently curved; interorbital region slightly depressed; eyes small, situated rather backward and high up; month small, maxillary not reaching orbit; six rows of scales on check; fins high. Head  $3\frac{1}{4}$ ; depth  $2\frac{1}{6}$ . D. XVII, 10; A. VI, 8. Lat. 1. 25. Rivers of Texas and Mexico.

(Herichthys eyanoguttatus B. & G. Proc. Acad. Nat. Sci. Phila. vii, 25, 1854: Günther, iv, 290.)

# Family XCVL—POMACENTRIDE.

(The Pomacentroids.)

Labroid fishes with the body short, deep, compressed, covered with etenoid scales; lateral line wanting posteriorly; month moderate, usually with rather strong teeth; vomer and palatines toothless; nostril single on each side,\* nearly round; preopercle with its posterior edge largely free; dorsal fin single, with the spinous portion longer than the soft, which is similar to the soft anal; anal spines 2; ventral fins thoracic, I, 5, the anterior rays longest. Lower pharyngeals fully united; branchiostegals 5–7; gills 3½; slit behind the last gill very small or obsolete; no labyrinthiform appendage; air-bladder and pseudobranchiae present; gill-membranes free from the isthmus. Vertebrae 12+14.

Fishes of the tropical seas, similar in mode of life to the *Chatodontida*, feeding on small marine animals and plants in the coral reefs. Genera 10; species about 160.

(Pomacentrida Günther, iv, 2-64.)

## 325.—POMACENTRUS Lacépède.

#### Demoiselles.

(Glyphidodon Lac.: Hypsypops, Pomataprion, and Euschistodus Gill.)

(Lacépède, Hist. Nat. Poiss. iv, 503, 1802: type Chatodon pavo Bloch.)

Body ovate, deep and compressed; the profile steep. Head moderate, nearly as deep as long, almost everywhere scaly. Month quite small, terminal; the jaws equal; both jaws armed with a single series of compressed teeth, notched or not, immovable. Gill-rakers long; preopercle entire, or more or less serrate; preorbital serrate or entire. Scales large, strongly etenoid, the lateral line running parallel with the back to near the end of the dorsal fin, at which point it ceases. Dorsal fin continuous, with 12 or 13 low stout spines; the soft part more or less elevated, its last rays gradually shortened; anal fin similar to soft dorsal, with two spines, of which the second is much the larger; dorsal spines with a sheath of large scales, the membranes of both dorsal and anal covered high up with small scales; caudal fin

<sup>\*</sup>As in the Cichlidæ. All other Acanthopteri have two masal openings on each side. Bull. Nat. Mus. No. 16——39

deeply forked. Branchiostegals 5 or 6. Species numerous in the tropical seas. (πῶνια, operculum; κεντρού, spine.)

a. Preopercle servate, at least in the adult. (Pomacentrus.)

# 956. P. leucostictus Müller & Troschel.

Dark brownish above, yellowish green on the sides and belly, yellow on the tail and caudal fin; numerous roundish bluish-white spots on the head, back, and soft portions of the dorsal and anal fins, the dots being less numerous on the sides; sometimes nearly uniform brown, almost unspotted; no spot on the back of the tail; a white dot on the base of the last anal rays; young with an occllated dorsal spot and convergent blue bands on the snout; upper profile of head arched; suborbital ring minutely denticulate posteriorly; preopercle serrulate; lower limb of preopercle scaly; upper and lower teeth nearly equally broad, entire; caudal forked, the lobes rather pointed. Depth  $2\frac{3}{4}$  in total. D. XII, 15; A. II, 13; scales 3-28-9. (Günther.) West Indies, north to West Florida.

(Müller & Troschel, Schomburgk's Barbad, 674; Günther, iv, 31; Goode & Bean, Proc. U. S. Nat. Mus. 1879, 338.)

aa. Preopercle entire.

b. Teeth entire. (Hypsypops\* Gill.)

# 957. P. rubicundus (Grd.) J. & G.—Garibaldi.

Uniform deep scarlet, unmarked; edges of fins dusky. Body short and deep, elevated, compressed, constricted behind the dorsal and anal, the caudal peduncle short and deep; head higher than long, the preorbital and suborbital regions being unusually deep; preopercle entire; cheeks, opercles, and top of head scaly; mouth small; lips thick; teeth compressed, narrow, blunt and entire, in a single row, dark at tips; gill-rakers short and flexible; preorbital anteriorly as wide as the eye; cheeks with 5 or 6 rows of rather small scales, opercles with several rows of larger ones; lips thick, the lower without frenum; soft fins rather high; pectorals reaching nearly to vent. Head  $3\frac{1}{3}$ ; depth  $1\frac{3}{4}$ . D. XII, 16; A. II, 15; scales 5–30–13; Lat. l. on 21 scales. L. 12 inches. Coast of California, south of Point Concepcion; abundant about rocky islands.

(Glyphisodon rubicundus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 148: Parma rubicunda Giinther, iv, 58: Hypsypops rubicundus Gill, Proc. Acad. Nat. Sci. Phila. 1863, 215.)

bb. Teeth emarginate. (Glyphidodon† Lacépède.)

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1861, 165; type Glyphisodon rubicundus Grd. ( $\dot{v}\psi i$ , high;  $\dot{v}\pi o$ , below;  $\dot{\omega}\psi$ , eye; in allusion to the high suborbital region.)

<sup>†</sup> Glyphisodon Lacépède, Hist. Nat. Poiss. iv. 542, 1802: type Glyphisodon moucharra Lac. = Chwtodon saxatilis Bloch.  $(\gamma\lambda\dot{\psi}\phi)$ 5, notch;  $\dot{\phi}\dot{\phi}\dot{\nu}$ 7, tooth.)

#### 958. P. concolor (Gill) J. & G.

Dark olive, with 5 or 6 vague, dark cross-bands; pectoral with a tapering, black transverse line at base. Interorbital space convex, wider than orbit; breadth of infraorbital ring two-thirds the greatest breadth of the preorbital. Teeth rather broad, deeply notehed. Depth 15. D. XII, 12; A. II, 9; scales 3-25-10. (Günther.) Both coasts of Central America, north to Florida Keys.

(Euschistodus concolor Gill, Proc. Acad. Nat. Sci. Phila. 1862, 145; Glyphidodon concolor Günther, iv, 37; Glyphidodon concolor Goode & Beau, Proc. U. S. Nat. Mus. 1879, 338.)

## 959. P. Saxatilis (Linn.) J. & G .- Cow-pilot; Mojarra.

Greenish olive; head and fins dark; body with 5 or 6 black cross-bands, which are rather narrower than the interspaces; the first from the origin of the dorsal to the pectoral fin, the second downwards from fourth and fifth dorsal spines, the third from the ninth and tenth dorsal spines toward the vent, the fourth from end of spinous dorsal to middle of anal, the fifth below the end of the soft dorsal and continued on the posterior rays of dorsal and anal; a faint sixth bar at base of candal. Soft dorsal and anal fins produced, the fourth and fifth rays of dorsal, and the fifth and sixth of anal, longest. Eye rather large, about as long as snout. Head rather short, 3½ in length; depth 1¾. D. X111, 14; A. II, 13; Lat. l. 27; pores on 21 scales. Tropical seas of America; occasional on our South Atlantic coast.

(Chwtodon saxatilis Linn. Syst. Nat.: Glyphidodon saxatilis Günther, iv, 35: Glyphidodon saxatilis Goode, Bull. U. S. Nat. Mns. v, 38.)

### 326 .- CHROMIS Cuvier.

(Heliastes Cuy, & Val.: Furcaria Poey: Ayresia Cooper,

(Cuvier, Mémoires du Mus. d'Hist. Nat. 1845; type Spavus chromis L. = Chromis castarca Risso, of the Mediterraneau.)

Body rather deep. Preopercle entire. Mouth small; teeth small, conical, in two or more series, the outer larger. Scales rather large, 24–30 in a longitudinal series. Dorsal fin with 12–14 spines. Branchiostegals normally 5. Pyloric coca 2. Gill-rakers long and slender. Tropical seas; species numerous. ( $\chi\rho\sigma\rho\lambda\tau$  the ancient name of some fish, probably a Scienoid, from  $\chi\rho\ell\rho\omega$ , to neigh, from the noise made by the fish; akin to our names Grunter, Croaker, Drum, Hog-fish.)

#### 960. C. punctipinnis Cooper.—Blacksmith.

Dark slaty blackish, with violet lustre above; some of the scales with a greenish spot or edging; fins bluish black; posterior part of

body with small round brown spots, which form more or less regular series; soft dorsal and caudal densely spotted. Body oblong, somewhat regularly elliptical. Head blunt, short, and deep, the profile abruptly descending to the snout. Lips thick, the lower without frenum. Teeth moderate, conical, in about two series, the inner very small. Cheeks, opercles, and top of head scaly. Spines stiff and low. Caudal forked; pectorals and ventrals long. Head 4; depth 2\frac{1}{3}. D. XII, 11; \( \Lambda \). II, 10; scales 4-29-10; 18 in course of lateral line; L. 9 inches. Pacific coast, north to Point Concepcion; not rare.

(Ayresia punctipinnis Cooper, Proc. Cal. Acad. Nat. Sci. 1833, 73.)

## 961. C. imsolatas (Cuv. & Val.) J. & G.

Dark brownish, with metallic reflections; each scale on the head and anterior part of the body with a blue spot; young with two blue lines along the forehead convergent on the snout, and with a black spot immediately behind the dorsal fin. Caudal fin emarginate, with rounded lobes. Second anal spine more than half the length of the head; dorsal spines high; ventrals long; pectorals moderate. Depth 2; D. XIII, 12; A. II, 12; scales 2-28-9; cœca 2. West Indies, north to Southern Florida.

(Heliases insolatus Cuv. & Val. v, 494: Heliastes insolatus Günther, iv, 61.)

# FAMILY XCVII—EPHIPPIDÆ.

(The Angel-fishes.)

Body compressed, usually greatly elevated, the anterior profile steep. Scales moderate or small, etenoid, densely covering the soft parts of the vertical fins; lateral line present, following the curve of the back. Month small, terminal, horizontal; premaxillaries protractile; maxillary short, without supplemental bone, partly slipping under the preorbital; jaws with bands of slender, pointed, movable, brush-like teeth; preopercle usually very finely serrated; gill-membranes broadly attached to the isthmus, the openings restricted to the sides; branchiostegals 6 or 7; pyloric eœca few; gill-rakers very short; pseudobranchiæ present. Dorsal fins 2, somewhat connected; the first of 8 to 11 spines, which are depressible in a groove; soft dorsal and anal fins anteriorly high, their bases thickened by the scales; anal spines 3 or 4, short; candal fin truncate or nearly so; pectorals short; ventrals long, thoracic, I, 5: air-bladder large, commonly bifurcate in front, and with two slends horns behind. As here understood, a group of 4 genera and about 19

species, closely related to the *Chwtodouts*, but said to show important differences in the skeleton. Fishes mostly of large size, in warm seas, sometimes entering rivers.

(Squamipinues part; genera Scatophagus, Ephippus, and Drepane, Günther, ii, 57-65.)

## 327 .- CHATTODIPTERUS Lacépède.

(Parcphippus Gill.)

(Lacépede, Hist. Nat. Poiss, iv, 503, 1802; typ.: Chwlodon plumieri Bloch == Chwlodon faber Brouss.)

Body much elevated and compressed, its outline nearly orbicular, the anterior profile nearly vertical. Scales small, 55–70 in the course of the lateral line. Jaws about equal; no teeth on vomer or palatines; teeth on jaws slender, somewhat movable; preopercle finely serrulate. Branchiostegals 6. Dorsal fins 2, somewhat connected, the first of usually 9 spines, the third of which is elongate; anal spines ε, small, the second the longest; ventral with a large accessory scale. Pyloric coea 4–6. American, distinguished from the Asiatic genus Ephippus by the very much smaller scales. (χαιτοδων, Chaetodon; δις, two; πτερον, fin, the dorsal being divided.)

962. C. faber (Brouss.) J. & G .- Angel-fish; Porgee.

Gravish; a dusky band across the eye to the threat; a second similar band, broader, beginning in front of the dorsal and extending across the base of the pectoral to the belly; a third band, narrower, extending to the middle of the sides, from the base of the fourth and fifth dorsal spines; a fourth broader band from the last dorsal spine to the anal spines, the remaining bands alternately short and long; all of these bands growing obscure and disappearing with age; ventrals black. Vertical fins low in the young, talcate in the adult. Third dorsal spine nearly as long as from eye to edge of preopercle, its membrane blackish; chin with a row of pores; preorbital nearly as wide as eye; pectoral considerably shorter than ventral, the first soft ray of the latter Head 3-31; depth 1]. D. VIII-I, 20; A. III, 18; Lat. l. 60; ccca 4-6. L. 2 feet. Warm seas; north to San Diego and New York; abundant on our South Atlantic coast; an excellent food-fish. Very large specimens, which we suppose to be old individuals, but which may possibly be a distinct species (Ephippus gigas Cuv.), have the occipital crest and anterior interharmals developed in thick bony masses.

(Chartodon faber Broussonet, Ichth. Decas. 1, v, t. 4, 1782; Chartodon faber Gmel. Syst. Nat. i, 1263, 1789; Zeus quadratus Gmel. l. c. 1225; Günther, ii, 61; Ephippus gigas Cuvier,

Règne Anim.: Ephippus gigas Günther. 11, 61: Ephippus gigas Holbrook, Ich. S. Car., 107: Ephippus faber Holbrook, I. c. 110: Ephippus zonatus Girard, U. S. Pac. R. R. Surv. 110. from San Diego.)

## FAMILY XCVIII.—CHÆTODONTIDÆ

(The Chatodonts.)

Body strongly compressed, elevated, suborbicular in outline, covered with moderate-sized or small scales, which are finely ciliated or nearly smooth; lateral line present, concurrent with the back, not extending on the caudal fin; mouth small, protractile, terminal; maxillary very short; teeth slender or setiform, often extremely long, in narrow bands in the jaws; no teeth on vomer or palatines; no canines, molars, or incisors; eyes lateral, of moderate size; branchiostegals 6 or 7; pseudobranchiæ very large; air-bladder present. Gill-membranes more or less attached to the isthmus; gill-rakers very small. Dorsal fin single, continuous, its rays sometimes filamentous, its soft part as well as the soft part of the anal densely covered with small scales; anal similar to the soft dorsal with 3 or 4 spines; ventrals thoracie, I, 5. Carnivorous fishes of the tropical seas, noted for their singular forms and bright colors. Genera 5 or more; species about 170, most of them belonging to Chætodon and Pomacanthus. (Squamipinnes part, Günther, ii, 1–57.)

#### 328.—CELETODON Linners.

(Sarothrodus Gill: Tetragonoptrus Bleeker.)

(Linnaus, Systema Natura, x, 1758: type Chatodon capistratus L.)

Body short, deep, very strongly compressed, especially above and behind; head small, compressed, almost everywhere scaly; mouth very small, terminal, the jaws provided with long, slender, flexible, bristle-like teeth; preoperculum entire or nearly so, without spine. Dorsal fin single, continuous, not notched, the spinous part longer than the soft part, of about 13 spines; last rays of soft dorsal usually rapidly shortened; caudal peduncle short, the caudal fin fan-shaped; anal similar to soft dorsal, preceded by 3 or 4 strong spines. Body covered with rather large ctenoid scales, somewhat irregular in their arrangement; the lateral line curved, high, parallel with the back. Gill-openings rather narrow, the membranes narrowly joined to the isthmus; branchiostegals 6. A very large genus of singular-looking fishes, abounding in the

tropical seas; most of them have the body crossed by transverse black bars. (χαίτη, bristle; δδών, tooth.)

## 963. C. maculocinetus (Gill) J. & G.

Olivaceous, darker above; a dark-brown band from beginning of dorsal fin obliquely forwards through eye and across the checks; a second bar beginning in a blotch on soft dorsal, runs vertically across the body. Body suborbicular, closely compressed; profile steep, concave, the short snout projecting; mouth very small, maxillary not reaching the vertical from the anterior nostril; candal pedancle very short; lateral line, beginning at upper angle of opercle, running obliquely upwards to opposite the base of soft dorsal and then decurved, ending opposite extremity of soft dorsal. Head  $2\frac{3}{4}$  in length; depth  $1\frac{1}{2}$ . D. XII, 19; A. III, 17. Atlantic coast, rare.

(Sarothrodus muculocinetus Gil!, Proc. Aca & Nat. Sci. Phila. 1851, 99.)

#### 329.—POMACANTHUS Lacépède.

(Chatodon, Holacanthus, and Acanthochatodon Bleeker.)

(Lacépède, Hist. Nat. Poiss. iv, 517, 1802: type Chatodou arcuatus L.)

This genus differs from *Chætodon* chiefly in the presence of a strong spine at the angle of the preopercle. Body much compressed and elevated; dorsal fin entirely scaly, with 8–15 spines; the anal with 3; scales moderate or small; branchiostegals 6; air-bladder with 2 posterior horns; pyloric cœca numerous. Species numerous in the tropical seas. Many of them are brilliantly colored.  $(\pi\tilde{\omega}\mu a, \text{ operculum}; \tilde{\alpha}z\alpha z\theta a, \text{ spine.})$ 

a. Dorsal spines 12 to 15. (Holacauthus\* Lac.)

## 954. P. ciliuris (Linn.) J. & G .. - Angel-fish; Isabelita.

Brownish olive, each scale with a crescent-shaped mark of lighter; nape with a dark-brown spot occilated with blue; chin, base of pectoral, borders and spines of opercle and preopercle bright cobalt blue; fins with blue and yellow. Body oblong, compressed and elevated; month small; scales ciliate; soft dorsal and anal with the anterior rays produced in long streamers. Head 4 in length; depth about 2. D. XIV, 20; A. III, 20; scales 8-50-30. West Indies, occasional on our South Atlantic coast.

(Cha todou ciliaris Linn, Syst. Nat.: Holacanthus ciliaris Lacépède, Hist. Nat. Poiss. iv, 527, 1\*02: Holacanthus ciliaris Günther, ii, 46: Holacanthus ciliaris Goode, Bull. U. S. Nat. Mus. v, 43.)

<sup>\*</sup>Lacépède, Hist, Nat. Poiss, iv, 525: type Chaetodon tricolor Bloch. (όλος, complete; απανθα, spine.)

aa. Dorsal spines 8 to 11. (Pomacanthus).

#### 965. P. arcuatus (L.) Lac.

Dark brown, anteriorly plain; lower jaw pale; each scale with a dark spot and a whitish edge; young with yellowish vertical bands, sometimes spotted with black; base of pectorals sometimes yellow. Scales on body small, firm; large and small ones irregularly mixed. Head with shagreen, formed of rudimentary scales. Dorsal and anal extremely falcate, the anterior soft rays two-thirds the length of the body in the adult; dorsal spines very low; last anal spine long. Mouth small; gill-rakers short; gill-membranes very slightly joined to the isthmus mesially. D. IX, 30; A. III, 24; Lat. l. 80–100; eeea 15; vert. 10+14. West Indies, north to Garden Key, Florida.

(Chartodon arcuatus L. Syst. Nat.: Pomacanthus paru, cingulatus, quinquecinetus, and arcuatus Cuv. & Val. vii, 202-211: Pomacanthus paru Günther, iii, 55.)

# FAMILY XCIX.—ACANTHURIDÆ.\*

(The Surgeons.)

Body oblong, compressed and usually elevated, covered with very small scales; lateral line continuous. Tail armed with one or more movable spines or bony plates. Eye lateral, high up; preorbital very narrow and deep. Nostrils double. Mouth small, low; each jaw with a single series of incisor-like teeth; vomer and palatines toothless; premaxillaries somewhat movable, but not protractile; maxillary short; gill-rakers obsolete; pseudobranchiæ large; gills 4, a slit behind the fourth; gill-membranes attached to the isthmus, the openings thus restricted to the sides. A single dursal fin, with strong spines, the spinous part of the fin about as long as the soft part; anal fin similar, shorter; ventral fins present, thoracie, mostly I, 5 (never I, 4, I, as in Teuthididae). Pelvic bone long, evident through the skin, as in Balistidae, with which group the Acanthurida have numerous affinities. Pyloric carea rather few. Air-bladder large. Herbivorous fishes of the tropical seas; genera 5 or more; species nearly 80, most of them belonging to Acanthurus.

(Acronarida Günther, iii, 356.)

ACANTHURUS, 330.

a. Tail with a movable lancet-like spine on each side; incisors serrate.

<sup>\*</sup>Called Teuthidida in the key on page 78.

#### 330 - ACANTHUEUS Bloch & Schneider.

(.1cronurus Gthr.; young.)

(Forskâl; Bloch & Schneider, Ichthyol, 1801, 211; type Chatodon chirurgus Bloch.)

Body ovate-oblong, compressed, covered with minute etenoid scales. Mouth rather small, with broad lobate or serrate incisors, which are sometimes movable. A movable spine in a groove on each side of tail. One dorsal fin, low and long, with 7–9 (sometimes fewer) spines; usually a procumbent spine before the dorsal; anal with 2 or 3 spines. Ventral rays I, 5. Caudal emarginate. Gill openings moderate, oblique, separated by a broad isthmus; operculum very short; preopercle oblique, with entire edge. Branchiostegals 5. Intestinal canal elongate. Vertebræ 9 + 13. (ἄzαzθα, spine; δυρά, tail.)

## 966 A. Chirungus Bl. & Schn.-Surgeon-fish; Doctor-fish.

Brownish; opercle with a black margin; sometimes a whitish band across tail at base of candal; sides with dark transverse bands; vertical fins with oblique, parallel, dark streaks. Body oblong, compressed, and not greatly elevated; profile little convex, somewhat undulated. Vertical fins high; candal moderately emarginate. Head 3½ in length; depth 2. D. IX, 25; A. III, 23. West Indies; occasional northward. (Bloch & Schneider, 214; Günther, iii, 329, in part; Pocy, Anales Soc. Hist. Nat. Espagn. 1880, 245.)

#### 967. A. correleus Bloch & Schneider.—Blue Surgeon: Barbero.

Deep bluish brown, with undulating pale blue longitudinal lines, especially on the dorsal and anal fins, where they become straight and oblique. Upper profile of snout slightly concave. Caudal fin more or less deeply forked, the lobes bordered with pale in the adult; caudal spine glassy, amber-colored; opercles striate. Body very deep. Depth 1½ in length. D. 1X, 28; A. III, 25. West Indies; occasional northward.

(Bloch & Schneider, 1801, 214; Pocy, Anal. Soc. Hist. Nat. Espagn. 1880, 244; Acanthurus nigricans Goode, Bull. V. S. Nat. Mus. v, 42 (not of L.): Acanthurus caraleus Günther, iii, 326.)

# FAMILY C.—TRACHYPTERIDÆ.

(The King-of-the-Herrings.)

Body clongate, strongly compressed, naked, the skin smooth or prickly. Lateral line present. Head short, the mouth rather small, terminal, with feeble teeth; premaxillaries protractile; opercles unarmed. Eye large, lateral. Branchiostegals 6. Gill-membranes separate, free from the isthmus; gills 4, a slit behind the fourth. Pseudobranehiæ well developed, in a pouch formed by a fold of the mucous membrane. Dorsal fin single, extending from the head to the tail, its rays all technically spinous, being neither articulated nor branched, but all very soft, flexible, and fragile; anal fin wanting; pectorals short; ventrals thoracie, the rays elongate, often less than I, 5 in number; caudal fin either rudimentary or else divided into two parts, the upper and larger fan-shaped, directed obliquely upward from the slender tip of the tail. Bones very soft, the muscles little coherent. Pyloric ecca very numerous. Vertebræ in large number. Deep-sea fishes, often of large size, found in most warm seas. Their extreme fragility renders them rare in collections, and the species are little known. Genera 3; species about 15. They have no intimate relation with any other of our families.

(Trachypterida Günther, iii, 300-311.)

#### 331.—TRACHYPTERUS Gouan.

# $King\mbox{-}of\mbox{-}the\mbox{-}Herrings.$

(Gouan, Hist. Poiss. 1770, 104: type Cepola trachyptera Ginel.)

This genus is characterized by the well-developed ventral fins, composed of 4–6 branched rays each, and by the presence of a long fanshaped caudal fin extending obliquely upward and backward from the end of the long and slender tail; lower lobe of the fin little developed; the anterior rays of the dorsal fin are usually elevated, and separated by a notch from the rest of the fin; the fin rays and the lateral line are often armed with prickles. Deep-sea fishes of large size.  $(\tau \rho a \chi v z, rough; \pi z z z \rho v z, fin.)$ 

## 968. T. altivelis Kner. - King-of-the-Salmon.

Bright silvery, with three large round black spots below the dorsal fin; a fourth near the abdominal edge, a little below the first of the back. Anterior rays of the dorsal fin elevated; the longest rays of the posterior part of the dorsal nearly as deep as the body; dorsal rays rough, a small spine at the base of each of them; caudal fin with the erect lobe well developed, its outer rays longer and stronger than the intermediate rays; rays of the lower lobe short; skin prickly, the lateral line armed with small bony shields, each provided with a spine.

Head 7; depth 7. D. 7, 169 to 190; C. 6-5; P. 11; V. 7. (Günther.) Described from Valparaiso, Chili. A young specimen examined by us from Santa Crnz, Cal., agrees in essential respects, except that the skin is entirely smooth. The prickles are perhaps acquired with age, otherwise ours may be a different species. Two specimens of Trachypterus have also been taken in Puget Sound, but they have not been preserved. (Kner. Wien. Sitzungsber, xxxiv, 437, 1859, taf. 1; Ganther, iii, 303.)

# FAMILY CL—ICOSTEIDÆ.

# (The Ronquils.)

Body oblong, compressed, naked or covered with small etenoid or cycloid scales. Head moderate, not externally bony, the opercles un-Mouth moderate, terminal; premaxillary protractile or not: maxillary moderate, without supplemental bone. Teeth small, in bands or in single series; vomer and palatines with or without teeth. No barbels. Lower pharyngeals separate. Branchiostegals 6 or 7. Gill-openings wide, the membranes free from the isthmus; gills 4, a slit behind the fourth; gill-rakers slender. Pseudobranchiæ large. Pyloric cæca few. Air-bladder present. Lateral line present. Dorsal fin very long, continuous, without distinct spines; anal long, without spines; caudal fin convex; ventral fins thoracic or sabjugular, separate, but very close together, I. 4, or I, 5; pectorals rounded, sometimes fleshy at base. Vent normal, without papilla. Skeleton more or less soft and cartilaginous. This group, as at present constituted, is composed of three very diverse genera, each of a single species, inhabiting the deeper waters of the North Pacific. It is probably most nearly related to the Malacanthidae, from which it is distinguished by the presence of pyloric cœca and by the non-labroid dentition.

(Icosteidæ Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 306.)

- a. Body naked, lateral line and fin rays beset with groups of spinules; skeleton not ossified. (Icosteina.)
- aa. Body covered with small scales; no spinnles; air-bladder wanting or rudimentary; ventrals 1, 5.
  - c. Skeleton imperfectly ossified; lateral line median. (Icichthyinw.)
  - cc. Skeleton ossified; lateral line near the back. (Bathymasterina.)
    - c. Teeth in bands, rather strong, on jaws, vomer, palatines, and pharyngeals; ventrals subjugular; caudal pedancle not slender.....BATHYMASTER, 334.

### 332.-ICOSTEUS Lockington.

(Lockington, Proc. U. S. Nat. Mus. ii, 63, 1880; type Icosteus aniamaticus Lockington.) Body oblong, much compressed throughout, the head thicker than any part of the body. Dorsal outline rising rapidly to the origin of the dorsal fin, thence more regularly curved; the region at the base of the dorsal and anal strongly compressed; candal pedancle slender, widened at the base of the fin. Mouth large, horizontal; maxillary narrow, reaching to beyond middle of eye. Teeth in jaws in one row, slender. sharp, closely and regularly set, those in the lower jaw largest; no teeth on vomer, palatines, or pharvngeals. Gill-rakers flexible, few; gill-membranes separate, free from the isthmus. Branchiostegals 6. Pseudobranchiæ well developed. Lateral line conspicuous, continuous, decurved, groups of small spines present along its entire length. No scales anywhere on body or fins. Fins rough, with small spinules; a series along each ray, dividing as the ray branches; dorsal fin commencing above the axil of the pectoral, composed of 50-60 rays, which are all soft and flexible, some of the anterior unbranched; the fin low in front, increasing in height behind; none of the rays more than once forked; anal shorter than the dorsal, similar to it, of 35-40 rays; some of the anterior apparently undivided; caudal fin elongate, fan-shaped, the middle rays produced; accessory rays numerous, procurrent; pectorals with a fleshy base, fan-shaped, the middle rays longest; ventrals thoracie, inserted just behind the pectorals, narrow, consisting of 1 short subspinous ray and 4 long soft rays. Air-bladder large. Vertebrae numerous, the vertebral column extremely flexible and soft. Cranial bones tolerably firm; bones of the face and opercles very flexible. Deep-sea fishes, from the Pacific. (ειχω, to yield, submit; οστεον, bone—the "entire body being characterized by a want of firmness, as it can be doubled up as readily as a piece of soft, thick rag.")

## 969. I. migmaticus Lockington.

Pellucid yellowish or brownish, with purplish spots and blotches of irregular form; the spots largest above, most numerous along the lateral line; fleshy bases of candal and pectorals spotted; throat and gill-membranes with dark punctulations; fins dusky, obscurely blotched. Longest ray of dorsal nearly reaching base of middle candal rays. Eye 6 in head, scarcely half the length of the snout or the width of the interorbital space; diameter of candal pedancle about  $5\frac{1}{2}$  in greatest depth. Head 4; depth 3. D. 52-55; A. 37-40; V. I. 4; Lat. I. 110-120

(groups of spines). L. about 12 inches. Pacific coast of United States; three specimens known, from deep water.

(Lockington, Proc. U. S. Nat. Mus. ii, 63, 1880.)

#### 333.-ICECHTELES Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 305; type Icichthys lockingtoni J. & G.)

Body elongate, not elevated, not compressed at the bases of the vertical fins. Head moderate. Eyes lateral. Month terminal, little oblique, with small, sharp teeth in one series, in the jaws only. Premaxillaries not protractile. Gill-membranes separate, free from isthmus; gill-rakers long. Pseudobranchiæ present. Branchiostegals 7. Body covered with small cycloid scales. Lateral line continuous, unarmed. Bases of fins without spinules; dorsal and anal fins long and low, composed of soft rays only; pectoral fins moderate, their bases fleshy, as in Icosteus; ventral fins small, thoracic, I, 5. Pyloric ecca about 6, large. Bones all very flexible, cartilaginous. Deep-sea fishes. (2200, to yield or submit; 27055, fish—in allusion to the flexible skeleton.)

## 970. I. lockingtomi Jor. & Gilb.

Plain brown, paler below, somewhat punctulate. Body oblong, somewhat compressed, the caudal peduncle rather slender. Head moderate. compressed, with vertical cheeks, rather broad and slightly convex above. the snout abruptly descending. Mouth moderate, little oblique, the slender maxillary scarcely widened at the tip, extending to beyond front of pupil; anterior edge of the premaxillary on the level of lower rim of eye; lips thin; premaxillary tapering backward, not forming the whole margin of the upper jaw; maxillary behind slipping entirely under the membranous edge of the preorbital; preorbital rather wide, with one or two series of rather large, thin, cycloid scales (other scales on head, if any, now lost on the typical example); lower jaw prominent, projecting in front, included at the sides. Teeth in jaws only, minute, sharp, closely and evenly set, larger and less numerous than in Icosteus anigmaticus. Eyes large, lateral, longer than snont, 4 in head. Cheeks rather wide; preopercle with a prominent crest, behind which are some radiating mucons cavities; the bone with a broad, prolonged, flexible, membranaceous edge, covered with radiating striæ, each of which ends in a flexible point. Opercle and subopercle rather large, extremely thin, and each crossed by radiating striae. Branchiostegals 7. Gill-rakers long, slender, sharp, close-set, and moderately stiff, their length nearly three-fourths the diameter of the eye. Scales very small, soft, and smooth, covering the body

evenly, but becoming smaller below. Lateral line nearly straight, anparently continuous. Dorsal fin long and low, beginning nearly midway between the vent and the base of the ventrals: all the rays soft and articulated, and all except the first branched; first rays very low. the fin gradually rising posteriorly, the highest rays 3 in head, somewhat scaly; anal fin similar, shorter, beginning slightly in front of the middle of the body and ending just in front of the last rays of the dorsal: caudal broad, fan-shaped, on a slender peduncle; the accessory rays numerous and procurrent: base of pectorals a little below the axis of the body, their outline rounded; the fin short and small, shorter than head; ventrals short and small, thoracic, placed a little behind pectorals, with 1 obsolete spine and 5 soft rays, one of which is slightly filamentous: the fin 3 in head: fin rays not beset with spinules. normal, immediately in front of the anal, without papilla. Air-bladder wanting. Bones all soft and flexible. The skin not thick and tough, as in Icosteus, but thin and scaled. Head 5; depth 4. D. 40; A. 28; Lat. 1. 120. L. 73 inches. Deep water off San Francisco, Cal.; one specimen known.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. ii, 305, 1880.)

## 321.—RATHWMASTER Cone.

(Cope, Proc. Amer. Phil. Soc. 1873: type Bathymaster signatus Cope.)

Body rather elongate, moderately compressed, covered with small ctenoid scales. Head rather large, subconic. Eyes large. moderate, nearly horizontal, the lower jaw slightly projecting; lips full; premaxillary protractile, not extending to the angle of the mouth; maxillary without supplemental bone, not slipping under the narrow preorbital. Teeth moderate, in a cardiform band in each jaw, the outer somewhat enlarged; bands of teeth on vomer and palatines. No barbels. Branchiostegals 6. Gill-membranes scattely connected, free from the isthmus; gill-rakers few, very short. Pseudobranchiæ large. Cheeks scaly; rest of head naked. Opercular bones unarmed. Mucous pores numerous on top and sides of head. Lateral line conspicuous, placed high, not reaching the candal fin, its scales a little enlarged. Dorsal fin long, continuous, moderately high; two or three of the foremost rays inarticulate, but no distinct spines; anal fin long, similar to the dorsal; caudal convex; pectorals rather broad, their bases extending obliquely downward and backward, their rays all branched; ventrals slightly in front of pectorals, I, 5, close together, the inner rays longest. Skeleton well ossified. Pyloric cœca few (2 or 3). No anal papilla. North Pacific. ( $\beta a\theta vz$ , deep;  $\mu a\sigma z \dot{\gamma} \rho$ , a searcher.)

## 971. B. signatus Cope.—Ronquil.

Olivaccous, tinged with brown: about 8 round, faint bluish blotches along the sides, each surrounded by rings of yellow spots; a yellow ring around the eye and a yellow band along the cheek; fins translucent, the anal with a yellowish stripe and a bluish edging; dorsal reddish or yellow, with a dusky blotch in front; yentrals dusky; larger specimens nearly uniformly dark. Eve large, about as long as snout, 4 in head: its diameter much more than interocular space: maxillary extending to below front of pupil; cheeks closely scaly; rest of head entirely naked: a narrow, naked area in front of dorsal, bounded by rows of mucous pores; skull with large mucous cavities behind the eyes, which are translucent in life; scales of lateral line enlarged, twice as far apart as the others. Dorsal fin inserted at a distance behind the occiput, less than the diameter of the eye; pectorals 5 the length of the head; fourth ray of ventrals longest; vent much nearer snort than root of caudal; caudal vertebræ about 33. Head  $4\frac{1}{6}$ ; depth  $6\frac{3}{2}$ . D. 41; A. 33; V. I, 5; P. 18; Lat. 1.92 + 6 (tubes); scales in about 200 transverse series. L. 12 inches. Alaska to Puget Sound, about rocks, in water of moderate depth.

(Cope, Proc. Amer. Phil. Soc. Phila, 1873.)

# Family CII (a) —LATILIDÆ.\*

(The Blanquillos.)

Body more or less elongate, fusiform or compressed. Head subconical, the profile usually convex; suborbital without bony stay; eranial bones not cavernous; opercular bones armed or not. Mouth moderate, terminal, usually little oblique; teeth rather strong; premaxillary usually with a posterior canine; premaxillaries protractile; maxillary without supplemental bone, not slipping under the edge of the preorbital. Gills 4, a long slit behind the fourth. Pseudobranchiæ well developed. Gill-membranes separate, or more or less united, often adherent to the isthmus. Lower pharyngeals separate. Scales small, etenoid. Lateral line present, complete. Dorsal fin long and low, usually continuous, the spinous portion always much less developed than the soft portion, but never obsolete; anal fin very long, its spines usually feeble and few;

<sup>\*</sup>Called Trachinida in the key on page 78; see also family 102 (b), Trichodontida.

caudal fin forked; tail diphycereal; ventrals thoracic or subugu'ar, I, 5, usually close together; pectoral fins not very broad, the rays all branched. Vertebræ in increased number (35–59). Pyloric cœca few or none. Fishes of the temperate and tropical seas, many of them reaching a large size. Genera about 5; species about 10.

(Trachinidæ, group Pinguipedina Günther, ii, 251-254.)

- a. Dorsal fin continuous; body scaly; upper jaws usually with posterior canines. (Latilina.)
  - b. Dorsal and anal with less than 20 soft rays each.
    - c. An adipose appendage at the nape: a fleshy prolongation on each side of the labial fold, extending backward, behind angle of the mouth.

Lopholatilus, 335.

#### 335.-- LOPECULATELUS Goode & Bean.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 205; type Lopholatilus chamwleonticeps G. & B.)

This genus differs from Caulolatilus and agrees with Latilus in the small number of dorsal and anal rays, and is distinguished from both by the presence of a large adipose appendage on the nape and by a tleshy prolongation upon each side of the labial fold, extending backward beyond the angle of the mouth. One species known. ( $\lambda \sigma \psi \sigma \tau$ , crest; Latilus.)

## 972. L. chamæleonticeps Goode & Bran.—Tile-fish.

Coloration brilliant; head and body with numerous greenish-yellow spots; upper portion of body with a violaceous tint; lower parts whitish, with some areas of yellow; caudal rays striped with greenish-yellow, some of the stripes connected by cross-blotches; and and ventral fins whitish; pectorals violet-tinted, with some yellow on posterior surfaces; soft dorsal with an upper broad band of violaceous and a narrow basal portion of whitish; many rays each with a yellow stripe; anterior part of fin with some yellow spots. Maxillary reaching anterior margin of orbit; opercle and preopercle scaly, the latter finely denticulate; upper jaw with an outer series of stronger teeth, behind which is a band of villiform teeth; lower jaw with a few large canines and an inner series of small conical teeth; vomer and palatines toothless. Head 3 in length; depth 3½. D. VII, 15; A. II, 13; scales 8–93–30. (Goode & Bean.) Abundant in deep waters off the coast of Massachusetts; a fine large fish, which may become important as food.

(Goode & Bean, P.oc. U. S. Nat. Mus. 1879, 205.)

#### 336.—CAULOLATELIS GIL.

## Blanquillos.

(Dekaya \* Cooper; preoccupied.)

(Caulolatilus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 240; nomen nudum, defined in Proc. Acad. Nat. Sci. Phila. 1855, 66; type Latitus chrysops C. & V.)

Body elongate, subfusiform, not strongly compressed, heavy forward, tapering to a rather slender caudal peduncle. Profile of head strongly arched. Mouth moderate, little oblique, the jaws nearly equal: lips thick; maxillary narrow, not slipping under preorbital; teeth in villiform bands, preceded by a row of stronger acute teeth; hindmost teeth in each jaw canine-like, directed forward; posterior canines of upper iaw largest; no teeth on vomer or palatines; preoperele pectinate, the teeth nearly even; opercle with a blunt, flat spine. Eves large, lateral. Gill-membranes slightly connected, forming a fold across the isthmus. with which they are narrowly joined. Branchiostegals 6. Gill-rakers short and stout. Nostrils double, round, close together. Scales small, firm, etenoid. Lateral line continuous, concurrent with the back. Dorsal with 7-9 slender, pointed, graduated spines, and 22-27 soft rays: anal similar to soft dorsal, with 1 or 2 small spines, and more than 20 soft rays; candal fin forked; ventral fins thoracic; no adipose appendage at the nape. Large fishes of the warm seas. (zavhoz, stem; Latilus i. e., many-rayed Latilus.)

## 973. C. princeps (Jenyns) Gill.—White-fish; Yellow-tail.

Olivaceous, with bluish reflections; brownish above, greenish below; fins light greenish olive, tinged with bluish and orange, the colors always pale; dorsal and anal greenish, with a bluish band near the tip; axil dusky. Flesh of the occiput becoming thick with age, as in *Harpe*. Eye large, about half the convex interorbital space,  $4\frac{1}{2}$  in head. Maxillaries reaching front of eye. Teeth rather strong. Preopercle finely, evenly, and acutely serrate behind, nearly entire below; preopercle, interopercle, and preorbital naked; cheeks and opercles scaly; top of head scaled on the median line to between the eyes. Dorsal spines flexible; ventrals slightly behind the pectorals, the outer rays longest; caudal moderately forked, the upper lobe the longer; caudal peduncle short and slender, abruptly contracted; pectorals falcate, longer than caudal,  $\frac{\pi}{6}$  length of the head. Head  $3\frac{\pi}{3}$ ; depth 4. D. 1X-

<sup>\*</sup> Dekaya Cooper, Proc. Cat. Acad. Nat. Sci. 1864, 741: type Dekaya anomala Cooper; not Dekayia Milne-Edwards & Haime, 1851; a genus of corals.

24; A. II, 23; scales 16-125-40. L. 40 inches. Monterey, southward, abundant about the Santa Barbara Islands; a food-fish of considerable importance.

(? Latilus princeps Jenyns, Zoöl. Beagle, Fishes, 52 (from Galapagos Islands): Dekaya anomala Cooper, Proc. Cal. Acad. Nat. Sci. iii, 71, 1864: Caulolatilus anomalus, princeps, and affinis Gill, Proc. Acad. Nat. Sci. Phila. 1865, 63: Caulolatilus anomalus Streets, Bull. U. S. Nat. Mus. vii, 48, 1877: ? Latilus princeps Günther, ii, 253.)

### 974. C. chrysops (C. & V.) Gill.-Blanquillo.

Reddish, marked with yellow; a yellow band below the eye and a dark axillary blotch. Body rather robust. Interorbital width half length of snout. Snout longer than maxillary. Eye small, 6 in length, of head in adult. Fins rather short; caudal slightly emarginate; pectoral not reaching origin of anal, not one-fourth of total length. Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{4}$  in length. D. VII-25; A. I, 23; Lat. l. 120; l. transv. 48. (Goode & Bean.) Pensacola, Fla., and southward.

(? Latilus chrysops Cuv. & Val. ix, 496, 1833 (from Brazil): ? Latilus chrysops Günther, ii, 253: ? Caulolatilus cyanops Poey, Rept. Fis. Nat. i, 312, 1867 (Cuba): Caulolatilus microps Goode & Bean, Proc. U. S. Nat. Mus. i, 43, 1878. The characters ascribed to the latter species, being details of form only, may be due to age, as greater differences occur between young and old of C. princeps.)

# FAMILY CII (b).—TRICHODONTIDÆ.

(The Sand-fishes.)

Body rather elongate, moderately compressed, naked. Head short, flat on top, the sides vertical. Eyes large, high up, but not superior. Mouth large, almost vertical; lower jaw projecting, its tip entering the profile; lips fringed; premaxillaries protractile; maxillary very broad, without supplemental bone, not slipping under the very narrow preorbital. Teeth moderate, slender and sharp, but not setiform, in bands on jaws and vomer; palatines toothless; inner teeth of jaws depressible. Gill-rakers very short; gill-membranes narrowly united, free from the istlimus. Branchiostegals 5. Gills 4, a slit behind the fourth. Preopercle with 5 prominent spines, the two upper directed strongly upward, the two lower downward, the middle one downward and backward; no barbels; opercle small, strongly striate, unarmed; preorbital with spines; no suborbital stay. Lateral line obsolete. Dorsal fins separate, the first the larger, of numerous slender, low spines; anal fin elongate, without distinct spines, the rays of the anterior third of the fin much shorter than the others; pectorals with a very broad, curved, procurrent base; a broad lunate area between pectoral and gill-opening, nearly covered by the opercle; soft rays of dorsal, anal, and pectoral fins all simple;

ventrals close together, thoracic, but behind the pectorals, I, 5, the middle rays longest; caudal lunate, with many accessory rays, on a slender peduncle. Two species known, from the North Pacific.

(Trachinida, genus Trichodon Günther, ii, 250.)

#### 337.—TRICHODON Steller.

(Steller; Cuvier, Règne Anim. ii, 1829: type *Trachinus trichodon* Tilesius.)

Characters of the genus included above. (θρέξ, hair; ὁδὼν, tooth.)

## 975. T. stelleri Cuv. & Val.—Sand-fish.

Olivaceous silvery, the back darker, with short bars and reticulations of blackish, the latter chiefly on the head and nuchal region; below this a longitudinal narrow white stripe, and then a narrow black stripe, interrupted anteriorly, extending from the eye to the base of the candal; spinous dorsal with 2 lengthwise bands of black; chin and snout black. Eye large, placed high, 3 in head; maxillary extending to beyond its middle; the premaxillary near the level of its upper edge; check quadrate, as deep as long. Pectorals reaching past vent, the lower rays rapidly shortened, the width of its base  $\frac{3}{4}$  its length, two-thirds the length of the head; anterior rays of anal less than half the height of the posterior. Head  $3\frac{1}{2}$ ; depth the same. D. XV-18; A. 9, 19. L. 12 inches. Coast of Alaska, south to San Francisco, burying itself in the sand near the shore; not rare northward.

(Trachinus trichodon Tiles, Mém. Ac. Petersb. 1813, 466; Cuv. & Val. iii, 154; Günther, ii, 251; Trichodon lineatus Ayres, Proc. Acad. Nat. Sci. Phila. 1860, 60.)

# Family CIII.—URANOSCOPIDÆ.

(The Star Gazers.)

Body more or less clongate, conic, terete or subcompressed, widest and usually deepest at the occiput. Scales small, smooth, adherent, arranged in very oblique series, rarely wanting. Lateral line feeble or obsolete. Head cuboid, partly mailed above. Eyes small, anterior, on the top of the head. Mouth vertical, the mandible strong and prominent; lips more or less conspicuously fringed; teeth moderate, on the jaws, and usually on vomer and palatines also; premaxillaries protractile; maxillary broad, without supplemental bone, not slipping under the preorbital. Gill-openings very wide, continued forwards; gill-membranes nearly separate, free from the isthmus. Brauchiostegals 6.

Gills 3½, a small slit behind the last. Pseudobranchiæ present. No anal papilla. Dorsal fins 1 or 2, the spinous part very short, the soft part elongate; anal long; candal not forked; pectoral fins with broad oblique bases, the lower rays rapidly shortened, most of them branched, ventral fins jugular, close together, I, 5, the spine very short, the innermost rays the longest. Air-bladder generally absent. Pyloric cœca in moderate number. Carnivorous fishes of singular appearance, living on the sea-bottoms in most warm regions. Genera 7; species about 20. (Trachinidæ, group Uranoscopina Günther, ii, 225-232.)

a. Dorsat fins 2: head without spines; no tentacle in the mouth. Astroscopus, 338.

#### 338 .- ASTROSCOPUS Brevoort.

(Agnus Günther: Upsclonphorus Gill.)

(Brevoort; Gill, Proc. Acad. Nat. Sci. Phila. 1860, 20; type Uranoscopus anoplos Cuvier.) Mouth large, the lower jaw without retractile tentacle within. Teeth narrow, in villiform bands, on jaws, vomer, and palatines; teeth of jaws depressible. Nostrils fringed; a curved furrow behind each eye, with its edges fringed. No spines about the head, the edges of the membrane bones covered by smooth skin; surface of the bones rugose; a . broad plate on the occipital region, from the middle of which a Yshaped projection extends forward, the tips of the fork being between the eyes: a trapezoidal space, covered by naked skin, bounded by the Y, the eye, the suborbitals and the occipital plate. Head scaleless; back and sides covered with close-set scales; belly mostly naked. Humeral spine obsolete: no spine before the ventrals. First dorsal small, of about 4 low, stout, pungent spines, connected by membrane to the second dorsal, which is rather high and long; pectorals and ventrals large. American, distinguished from the Old World Uranoscopus chiefly by the unarmed head. (αστδον, star; σχοπέω, to look.)

## 976. A. y-græcum (C. & V.) Gill.

Dark brown above, paler below; upper parts densely covered with small rounded white spots, each surrounded by a black ring; lower jaw and labial fringes similarly spotted; spinous dorsal black, white posteriorly; soft dorsal with 2 black and 2 white stripes; caudal black, with 2 white longitudinal stripes, its upper and lower edges narrowly white; anal white at base and tip, with a black median band; pectorals brown, with a black band below, the lower edge white, the

upper ray spotted; ventrals white. Width of pectorals less than half length of head, their length a little less than that of head; ventrals reaching three-fifths distance to vent. Scales small, evident, in very oblique series. P-shaped bone on top of head conspicuous, on each side of it a broad naked area, said to be the seat of electric powers. A ridge of skin along middle line of belly from ventrals to vent. Head 3; depth 3. D. IV-I, 13; A. 12. L. 12 inches. West Indies, occasional on our South Atlantic coast.

(Uranoscopus y-gracum Cuv. & Val. iii, 208, 1829): Uranoscopus y-gracum Giinther, ii, 229): Upselonphorus y-gracum Gill, Proc. Acad. Nat. Sci. Phila, 1861, 113; Bean, Proc. U. S. Nat. Mus. 1879, 58.)

## 977. A. anopius (Cuv. & Val.) Brevoort.

Brownish, everywhere covered with fine white spots; a dark lateral band on the caudal pedancle, near which the spots are larger; caudal with lengthwise stripes of black and pale. Form and armature essentially as in A. y-gracum. Pectoral a little longer than ventral, one-fourth shorter than the head. Scales on back evident, but small, the belly and lower part of the sides naked. Head  $2\frac{1}{2}$ ; depth  $3\frac{1}{3}$ . D. IV-13; A. 12; Lat. l. 113. Atlantic coast of United States; rare.

(Uranoscopus anoplos Cuv. & Val. viii, 493 (young, said to be naked): Agnus anoplus Giinther, ii, 229: Astroscopus guttatus Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 365; Bean, Proc. U. S. Nat. Mus. 1879, 60.)

# FAMILY CIV.—GOBIID.E.

(The Gobies.)

Body oblong or elongate, naked or covered with etenoid or cycloid scales. Dentition various, the teeth generally small; premaxillaries protractile; suborbital without bony stay. Skin of head continuous with covering of eyes. Opercles generally unarmed. Pseudobranchiae present. Gills 4, a slit behind the fourth; gill-membranes united to the isthmus, the gill-openings thus restricted to the sides. No lateral line. Dorsal fins separate or connected, the spinous dorsal least developed, of 2–8 flexible spines, rarely wanting; anal usually without spine, similar to the soft dorsal; ventral fins close together, separate or fully united, each composed of a short spine and 5 soft rays, the inner rays longest; the ventral fins, when united, form a sucking-disk, a cross-fold of skin at their base forming a cup; caudal fin convex; anal papilla prominent. No pyloric cœca; usually no air-bladder. Carnivorous fishes, mostly of small size, living on the bottoms near the shores in warm regions. Some

inhabit fresh waters, and others live indiscriminately in either fresh or salt water. Genera 60-70; species nearly 400.

(Gobiide part; groups Gobiina, Amblyopina, and Trypauchenina Günther, iii, 1-138.)

- \* Ventrals separate; body scaly. (Electriding.)
- aa. Vomerine teeth wanting; istlimus broad.
  - b. Scales small (60-100 in a lengthwise series); teeth fixed......Eleotris, 340. bb. Scales large (30-35 in a lengthwise series); outer teeth movable.

DORMITATOR, 341.

- \*\* Ventral fins united.
  - c. Dorsal fins separate. (Gobiina.)
    - d. Dorsal spines several.
      - e. Body sealy.
        - f. Scales etenoid; dorsal spines 6; maxillary moderately developed, ending below the eye.
          - - hh. Teeth all simple.
              - i. Teeth in the upper jaw in one series; those below in a very narrow band ......Euctenogobius, 343.
              - ii. Teeth in several series in each jaw.
        - ff. Scales very small, cycloid.

          - kk. Maxillary moderately developed; dorsal spines 7 or 8.

Lepidogobius, 347.

#### 339.—PHILVPNUS Cavier & Valenciennes.

(Lembus Günther.)

(Cuv. & Val. Hist. Nat. Poiss, xi, 255, 1837: type Platycephalus dormitator Bloch & Schn.)

Body elongate, terete anteriorly, compressed behind. Head elongate, depressed above. Month large; lower jaw longest. Teeth cardiform, on jaws and vomer; no teeth on palatines and tongue. Gill-openings continued forward below, so that the isthmus is very narrow. Scales moderate, etenoid, covering most of the head. Dorsal fins well separated, the first of 7 spines; ventrals separate. Largest of the Gobies, some of the species reaching a length of nearly 2 feet. Tropical rivers and bays. (ψίλοπνος, slumber-loving.)

### 978. P. dormitator (Bl. & Schn.) Cuv. & Val.

Brownish, marbled with darker; sides of head with 2 brown stripes; fins rose-colored, with series of brown spots; two oblong brown spots on base of pectorals. Snout sharp; maxillary reaching to opposite middle of orbit. Vomerine teeth in a crescent-shaped band. Eye small, half width of interorbital space. Candal peduncle very long and rather slender. Head 3 in length; depth about 5½. D. VI-I, 9; A. I, 9; Lat. l. 60. L. 1-2 feet. Texas and southward, entering the rivers.

(Plutycephalus dormilator Bl. & Schn. 60, 1891; Elcotris dormilatrix Günther, iii, 119; Cuy. & Val. xii, 255.)

### 340.-ELEOTRIS Grenow.

#### Tétards

(Gobiomorus and Gobiomoroides Lacépède.)

(Gronow: Bloch & Schneider, Syst. Ichth. 1801, 65: type Electris gyrinus Cuv. & Val.)

Body long and low, compressed behind. Head long, low, flattened above, without spines or crests, almost everywhere scaly. Month large, oblique, the lower jaw projecting. Teeth in jaws villiform, fixed; no teeth on vomer or palatines. Preopercle and branchiostegals unarmed. Eyes small, high, anterior; isthmus broad. Dorsal fins well apart, the first of about 7 flexible spines; ventrals separate. Scales small, cycloid, 60–100 in a longitudinal series. Tropical seas, entering fresh waters.  $(\sqrt[4]{\lambda z} \delta \tau)$ , bewildered.)

## 979. E. gyrinus Cuv. & Val.-Tétard; Sleeper.

Brownish; vertical fins, with brown dots; two darker stripes behind the orbit. Body elongate, moderately compressed, of nearly equal depth throughout. Candal peduncle long and deep. Head rather broad and flattened above, its scales minute. Month large, very oblique; maxillary reaching beyond the vertical from centre of orbit. Eye small, half width of interorbital space. Head 3½ in length; depth about 5. D. VI-1,8; A. I, 8; Lat. l. about 60. Brackish waters, from Texas southward.

(?Gobius pisonis Guelin, Syst. Nat. 1788, 1203; Cuv. & Val. xii, 220; Giinther, iii, 122.)

#### 344.-DODERNEE'D'A'TOER Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 240; type Electris gundlachi Pocy.)

Body oblong, the back broad and elevated; the head broad and deep. Month small, anterior; jaws subequal, each with a narrow band of slender teeth, those in the outer row movable; no teeth on vomer or palatines. Eyes moderate, lateral, wide apart. Head unarmed, almost

everywhere scaly. Scales large, etenoid. Isthmus moderate; gill-clefts extended a little forward above; gill-rakers long. Pharyngeal teeth setaceons; an external series broad, flexible, lamelliform. Dorsal spines flexible, usually 7; ventrals separate. Brackish waters in the tropics. (Latin, dormitator, one who sleeps.)

#### 980. D. lineatus Gill.

Brownish-yellow, thickly punctulated with darker, with a dark line running along the midd e of each row of scales, and with a dark vertical blotch on the scapular region; head apparently with 2 dark longitudinal bands; dorsal and anal fins with 2 rows of dark spots near the base, a fainter one beyond; all the fins with minute dark dots. Head  $3\frac{1}{3}$  in length; depth about  $3\frac{1}{2}$ . Eye equal to snout. D. VII-I, 10; A. I, 10; Lat. l. 32. (Gill.) Savannah, Ga.; probably identical with the next. (Gill, Proc. Acad. Nat. Sci. Phila. 1863, 271.)

#### 981. D. maculatus (Bloch.) Gill.—Sleeper.

Dark brown, with lighter bluish spots; a faint dark stripe along sides; a large dark blue spot edged with black above base of pectorals, and a dark streak from eye to angle of mouth; two dark streaks on side of head; branchiostegal membrane blackish; dorsals barred with spots; anal dusky, barred with bluish, and with white margin; a dark bar on base of pectoral. Caudal a little shorter than head. Eye small, shorter than snout. Head  $3\frac{1}{5}$  in length; depth about 3 (in the adult). D. VII-9; A. 10; Lat. l. 33. L. 12 inches. Rio Grande and southward to Guiana and Equador; very abundant in brackish waters. (Here described from specimens from Mazatlan.)

(Sciana maculata Bloch, Ichth. taf. 299, f. 2: Electris mugiloides C. & V. xii, 265; Electris maculata Giinther, iii, 112: Electris summulentus Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 28: Electris somnolenta Giinther, iii, 557: Dormitator omocyancus Poey, Syn. Pisc. Cubens, 396.)

#### 342.-EVORTHODUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1859, 195: type Erorthodus breviceps Gill.)

Body elongate, covered with etenoid scales of moderate size. Head thick, short. Isthmus moderate. Teeth in a single series, with the crown emarginate, those of the lower jaw horizontal; no canines. First dorsal of 6 spines; ventral fins united, not adherent to the belly. ( $\varepsilon v$ , well;  $a\rho\theta a\varepsilon$ , straight;  $a\theta av\varepsilon$ , tooth.)

#### 982. E. catolins (Grd.) Gill.\*

Olivaceous, with cross-blotches of darker. Body subfusiform. Head

<sup>\*</sup>We are informed by Professor Gill that this species, or a species supposed to be the same, is an *Everthodus*. The types are now lost.

not very blunt. Jaws even. Mouth somewhat oblique; maxillary extending to opposite the pupil; isthmus very wide. Dorsals well separated, the second somewhat longer than the first; anal short, inserted behind front of second dorsal; ventrals not reaching to vent; pectorals broad and rounded, reaching vent; dorsal spines not filiform. Head 3½; depth about 4. D. VI-II; A. II; Lat. I. 30. Saint Joseph's Island, Tex. (Girard.)

(Gobius catulus Girard, U. S. Mex. Bound, Surv. Ichth. 1859, 26.)

#### 343.-EUCTENDIOREUS GIL

(Gill, Ann. Lyc. Nat. Hist. N. Y. vii, 45, 1859: type Euctenogobius badius (Gill.)

This genus differs from *Gobius* in the dentition, the teeth being pointed, in a single series in the upper jaw and in a very narrow band in the lower. (25, well; 27225, comb; *Gobius*; from the etenoid scales.)

## 983. E. Lyricus (Grd.) J. & G.

Brownish, obscurely barred with darker. Body oblong-clongate, tapering slightly from occiput to candal peduncle. Head oblong, compressed. Snout very blunt; profile in front of eyes nearly vertical. Mouth moderate, nearly horizontal; maxillary reaching beyond middle of orbit. Teeth conical, rather strong, in two rows in front of lower jaw, in one on the side, and in one in the upper jaw. Fins all high; middle rays of spinous dorsal produced; caudal lanceolate; pectoral reaching beyond tips of ventrals, which reach the vent. Head 4½ in length; depth about 4½. D. VI-41; A. 11; Lat l. 32. Rio Grande.

(Gobius lyricus Girard, Proc. Acad. Nat. Sci. Phila, 1858, 169: Gobius lyricus Giinther, iii, 550.)

#### 311.-GOBIUS Linneus.

## Gobies.

(Artedi: Linnans, Syst. Nat.: type Gobius niger L.)

Body oblong or elongate, compressed behind. Head oblong, more or less depressed. Eyes high, anterior, close together; opercles unarmed. Mouth moderate. Teeth on jaws only, conical, in several series, those in the outer row enlarged; no canines; isthmus broad. Scales moderate, etenoid; cheeks usually naked; belly generally scaly. Dorsal usually with 6 spines; pectorals large; ventrals completely united, not aduate to the belly; candal fin usually obtuse. Species very numerous. Our species are very little known, and some of them may not belong to this genus.  $(z\omega_i z\omega_5;$  Latin, Gobius or Gobio, a name applied to the gudgeon (Gobio fluriatilis) and to other small fishes; allied to Cobitis, chub, etc.)

<sup>\*</sup> Body entirely scaly.

a. Upper rays of pectorals partly free, finely branched, silk-like.

## 984. G. soporator Cuv. & Val.

Dark brownish-olive, marbled with darker, and with lighter dots along the series of scales; fins all blackish, the dorsal and caudal more or less distinctly barred; a dark blotch on temporal region. Body rather stout. Eye rather large, slightly less than snout. Head rather broader than high. Mouth rather large; jaws equal; maxillary to middle of eye. Cheeks naked; scales on nape much smaller than those on body; opercle not longer than eye; distance of first dorsal from eye equals that of snout from preopercle; upper rays of pectoral silk-like, the fin not quite as long as caudal, shorter than head; ventrals not reaching the vent, their basal membranes very broad. Head 3; depth  $4\frac{2}{5}$ . D. VI-I, 9; A. I, 8; Lat. l. 35; l. trans. 13. Both coasts of Mexico; very abundant southward, north to Florida.

(Cuv. & Val. xii, 56; Günther, iii, 26.)

#### 985. G. carolinemsis Gill.

Blackish-brown, indistinctly marked with lighter; a darker spot at base of caudal; a few light spots on operculum; fins purplish. Head  $4\frac{1}{5}$  in total length (with caudal); depth about 5; caudal peduncle  $\frac{1}{6}$  of total length, its height  $\frac{1}{9}$  of the same; eye 4 in length of head; upper rays of pectorals silk-like; caudal  $\frac{1}{5}$  total length, as long as pectoral. D. VI-I, 9; A. I, 8; Lat. l. 38; L. tr. 14; P. 18. (Gill.) Charleston, S. C.; the type now destroyed; probably identical with G. soporator.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 268.)

#### 986. G. gulosus Grd.

Olivaceous, with transverse black spots on the back and longitudinal ones on the head. Snout subconical, the mouth very large, oblique, the lower jaw included; maxillary extending beyond the orbit. Eyes small, superior, their length 5 in head, twice the interocular space; isthmus moderate. Dorsals well separated, the first with some rays filiform; dorsal and anal barely reaching base of caudal; ventrals reaching vent; pectorals longer than ventrals; caudal rounded; scales moderate. Head nearly one-fourth the total length. D. VI-15; A. 15. Indianola, Tex. (Girard.)

(Girard, U. S. Mex. Bound, Surv. Ichth. 1859, 26.)

## 987. G. würdemanni Grd.

Appearance of *Gobius lyricus*. Reddish-brown, obscurely barred with dusky. Head larger; caudal shorter; ventrals shorter; anal lower; scales smaller than in *G. lyricus*; teeth very slender, much smaller than in *G. lyricus*. Third dorsal spine filamentous. D. VI-11; A. 12.

Brazos Santiago, Tex. (Girard.) Like the preceding, a dubious species, which may not belong to this genus.

(Girard, U. S. Mex. Bound, Surv. Ichth, 1859, 25.)

aa. Pectoral with its upper rays normal, simple, or nearly so; scales large. (Cory-phopterus\* Gill.)

## 988. G. glaucofræmum (Gill) J. & G.

Tawny, with a faint blue spot in the center of each scale, and with 6 spots, each formed by aggregation of dark dots, on the ridge of the back between the second dorsal spine and the axil of the soft dorsal fin; another row of similar but fainter spots runs from the scapular region, and a third row along the middle of the sides; head tawny, with dark spots and blue dots; a straight blue line across the checks; dorsal fins with faint blue spots. Body robust, compressed; head naked; mouth oblique, the lower jaw slightly projecting, the maxillaries extending to below pupil; teeth long, in many series, the outer curved; scales etenoid, large. Pectoral fin with the upper rays little branched, not silk-like; checks scarcely tunid; candal and pectoral longer than ventrals, about as long as head. Head  $3\frac{1}{6}$ ; depth  $4\frac{1}{6}$ . D. VI-10; A. I, 9; P. 18; Lat. l. 25; l. transv. 7. L.  $1\frac{1}{2}$  inches. Coast of Washington Territory. (Gill.) The original type is now lost, and the species has not been rediscovered.

(Coryphopterus glaucofrænum Gill, Proc. Acad. Nat. Sci. Phila. 1863, 263.)

#### 345.—GORHONELLUS Girard.

Emerald-fishes.

(Smaragdus Poey.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1858, 168: type Gobius lanceolatus Bloch.)

Body extremely long and slender, the depth contained more than six times in the length to base of caudal. Scales small, etenoid. Head not depressed, obtuse-convex, scaly above; cheeks and opercles naked; no barbels. Teeth small, in narrow bands, those in the outer row in the lower jaw setaceous, movable, in the upper jaw somewhat larger, fixed; no canines; lower jaw thin and flat. Dorsal with 6 spines; soft dorsal and anal many-rayed; caudal lanceolate. "Base of the tongue tuberculate, and shining with bright blue and green reflections, like a a precious stone" (hence the names *Smaragdus*, *Esmeralda*, etc.). Vertebræ elongate, 11 + 15. (A diminntive of *Gobius*.)

<sup>~</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1863, 262: type Coryphopterus glaucofrwnum Gill. ( $ro\rho\tilde{v}\psi\acute{n}$ , summit;  $\pi\tau\epsilon\rho\sigma\nu$ , fin.)

### 989. G. oceanicus (Pall.) J. & G.

Brownish, lighter below; a faint dusky streak along sides; a dark bar below eye; tins unicolor; pectorals dusky. Body much elongate, of equal depth throughout. Head short; profile very convex. Mouth large, oblique; jaws equal; maxillary reaching to below middle of orbit. Dorsal spines more or less elevated, filiform, usually higher than the soft rays; caudal from  $\frac{1}{3}-\frac{1}{2}$  of length of body; pectoral slightly longer than head or than ventrals, none of its rays silk-like; basal membrane of ventrals well developed. Head  $5\frac{1}{2}-6$  in length; depth about  $7\frac{1}{2}$ . D. VI-13; A. 14; Lat. l. 69-70, the scales much smaller and crowded, anteriorly. Coast of Texas to Guiana.

(Gobius occanicus Pallas, Spicilegia, viii, 4, 1769, after Gobius cauda longissima acuminata Gronow: Gobius lanccolatus Bloch. Fische Deutschl. ii, 12, pl. 38, f. 1, 1784: Gobius lanccolatus C. & V. xii, 114: Gobius bacalaus C. & V. xii, 119: Gobius lanccolatus Ginther, iii, 50: Gobionellus hastatus Girard, Proc. Acad. Nat. Sci. Phila, 1858, 169: Gobionellus hastatus Girard, U. S. Mex. Bound. Surv. 1859, 24.)

#### 316.-GILLICHTHYS Cooper.

(Cooper, Proc. Cal. Acad. Nat. Sci. 1863, 111: type Gillichthys mirabilis Cooper.)

Body moderately elongate, compressed, covered with small, cycloid, imbedded scales; belly and head naked. Eyes small, almost superior. Gape wide, the maxillary in the adult inordinately developed, prolonged backward to the base of the pectorals; its posterior part a cartilaginous expansion, connected to an expansion of the skin of the lower jaw, thus forming a channel backward from the mouth, almost exactly as in the Blennioid genus *Neoclinus* and the Trachinoid genus *Opisthognathus*. Teeth small, even, in broad bands. Dorsal fins 2, the second high, the first of 6 very weak spines, none of which are exserted; caudal rounded; pectorals large; isthmus broad. Singular little fishes, in brackish waters, burrowing in the mud.

(Dedicated to Theodore Gill.)

#### 990. G. mirabilis Cooper.—Mud-fish.

Dull olive, very finely marbled with darker; sides of head and maxillary finely punctate; fins olive; belly and ventrals yellowish. Body rather stout, somewhat compressed. Eyes small, high, anterior; maxillary in the adult reaching past base of pectorals, proportionately smaller in the young; in the very young the bone is scarcely larger than in other *Gobies*. Scales very small, smooth; belly and head naked, showing prominent veinings; dorsal spines very weak. Head  $3\frac{1}{5}$ ; depth  $4\frac{1}{5}$ ; maxillary, in adult, 3. D. VI-13; A. I, 10. L. 6 inches. Pacific

coast of United States, extremely abundant southward. It lives in shallow creeks and lagoons, where it fills the bottoms with holes and tunnels.

(Cooper, Proc. Cal. Acad. Nat. Sci. 1833, 111.)

#### 2 17 .- B. REPPENDAGE CONTRACTOR CONT.

(Cuclogobius Steindachner.)

(Gill, Ann. Lyc. Nat. Hist. N. Y. 1859, 14: type Gobius gravilis Grd.)

Scales small, cycloid; dorsal spines 7 or 8; otherwise essentially as in Gobius. Pacific Ocean. ( $\lambda \varepsilon \pi \iota \partial \sigma \varepsilon$ , scaly; Gobius.)

a. Head scaly. (Lepidogobius.)

### 991. L. gracilis (Grd.) Gill.

Very pale olive, with roundish blotches of rusty red on back and sides; vertical fins mottled with reddish; distal half of all fins and under side of head blackish, especially in the males. Body elongate, long and low, little compressed, covered with thin, smooth, half-imbedded scales. Head scaly above and on cheeks and opercles; mouth oblique; jaws equal; maxillary extending to below middle of eye. Teeth in rather broad bands, the onter teeth enlarged, especially in upper jaw; outer teeth in lower jaw somewhat movable. Eyes large, placed high, the interocular space very narrow; opercle adnate to scapular arch from upper edge of pectoral upward. Fins rather high, the dorsal spines slender, flexible and exserted at tip; pectorals short, not reaching so far as tips of ventrals; ventrals inserted slightly behind axil of pectorals; basal sheath of ventrals large. Head 4; depth 6½. D. VII-18; A. 15. L. 5 inches. Pacific coast of United States; common northward, in rather deep water.

(Gobius gracilis Girard, Proc. Acad. Nat. Sci. Phila. 1854, 134, not of Jenyns: Gobius lepidus Girard, U. S. Pac. R. R. Sarv, Fish. 127: Gobius lepidus Giinther, iii, 78.)

ua. Head naked. (Eucyclogobius\* Gill.)

## 992. L. mewberryi (Grd.) Gill.

Olivaceous, mottled with darker; spinous dorsal and anal tipped with dusky; second dorsal and caudal checkered; pectorals transparent; head with some dusky markings. Body short, chubby, little com-

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1862, 330: type Gobius newberryi Grd. "The genus Eucyclogobius is very distinct from Lepidogobius, differing especially in the robust, subfusiform body, the size and position of the eyes, wider forchead, shape of jaws, and especially the position of the ventral fins." (Gill, Proc. Acad. Nat. Sci. Phila. 1863, 264.) (ευ, well; πυπλος, cycloid; Gobius.)

pressed. Head large, rounded above, the snout broad. Mouth large. oblique, the lower law somewhat projecting; maxillary extending to considerably beyond the posterior margin of the small eye. rather strong, in narrow bands, the outer row larger; outer teeth of lower jaw somewhat movable. Opercle adnate to scapular arch from upper edge of pectoral upwards. Scales very small, cycloid. Head Fins moderate: dorsal spines very slender, not filamentous, lower than the soft rays; caudal truncate, about as long as pectorals, and considerably shorter than head; ventrals inserted under lower anterior edge of pectorals. Head  $3\frac{3}{4}$ ; depth  $4\frac{1}{4}$ . D. VIII-12; A. 11; Lat. l. about 60. L. 21 inches. Coast of California; rare.

(Gobius newberrii Girard, Proc. Acad. Nat. Sci. Phila. 1856, 136: Gobius newberrii Günther, iii, 72: Eucyclogobius newberrii Gill, Proc. Acad. Nat. Sci. Phila. 1863, 265.)

#### 34S .- GOBIOSOMA Girard.

(Girard, Proc. Acad. Nat. Sci. Phila, 1858, 169; type Gobius alepidotus Bloch & Schneider.)

This genus differs from Gobius mainly in the entire absence of scales. The teeth are in several series, the outer row enlarged, and there are no canines. Dorsal spines usually 7. (Gobius:  $\varsigma \tilde{\omega} \mu a$ , body.)

## 993. G. alemidotum (Bl. & Schn.) Girard.

Olive brown, with 7 or 8 paler transverse bars; fins dark brown; eandal with 2 or 3 curved bars. Body elongate, little compressed. Head somewhat flattened above; month rather small; maxillary extending nearly to opposite middle of orbit. Caudal fin pointed. Head 34; depth about 54. D. VII-14; A. 11. South Atlantic coast of United States.

(Gobius alepidotus Bl. & Schn. 547, 1801; Giinther, iii, 85: Gobius boscii C. & V. xii, 95.)

#### 994. G. molestum Girard.

Dusky brown; fins with blackish streaks. Head large, depressed; snout rounded; jaws even; maxillary scarcely reaching pupil. Caudal fin rounded, shorter than head; anal shorter than second dorsal; ventrals small, not reaching vent; pectorals broad, reaching beyond the ventrals; dorsals contiguous; isthmus very wide. Body short and chubby. Head  $3\frac{1}{5}$ ; depth  $4\frac{1}{2}$ . D. VII-12; A. 12; P. 16. (Girard.) Coast of Texas; ascending streams, said to have been once taken at the Falls of the Ohio.

(Girard, Proc. Acad. Nat. Sci. Phila. 1858, 169; Günther, iii, 556.)

## 319 .- TWPILL GORIUS Steindachner.

(Othonops Rosa Smith.)

(Steindachner, Ichth. Beiträge, viii, 142, 1879; type T. californicusis Steind.)

Body moderately elongate, compressed, covered with loose, smooth, naked skin. Head large, depressed, with tumid cheeks. Mouth large, the maxillary reaching to beyond the orbit; jaws equal, each with a narrow band of villiform teeth, the outer teeth slightly enlarged; lower jaw capable of little motion; snout rounded; no cirri. Eyes very small, imperfect, covered by skin. Fins low; first dorsal of 2 flexible spines; second dorsal moderate; anal very short; caudal rounded; ventral disk as in Gobius. Gill-openings rather narrow. One species known. (τοφάδτ, blind; Gobius.)

#### 995. W. californiensis Steind.

Bright pellucid pink in life, the upper parts somewhat speckled; top of head with slight wrinkles of skin. Insertion of first dorsal midway between snout and base of caudal; insertion of anal opposite fifth ray of soft dorsal; pectorals as long as caudal, extending beyond ventrals to first dorsal; fin rays covered by loose skin. Eyes visible in life as small dark specks, disappearing in alcohol. Head  $3_4^3$ ; depth 5. D. II-11; A. 7; P. 16. L. 3 inches. San Diego, Cal.; burrowing in sand among rocks.

(Steindachner, Ichth. Beitr. viii, 142, 1879; Othonops cos Rosa Smith, Proc. U. S. Nat. Mus. 1881, 19.)

## 350.—TYNTLASTES Günther.

(Günther, Proc. Zoöl. Soc. London, 1862, 194: type Amblyopus sagitta Günther.)

Body elongate, compressed, covered with small, imbricate, cycloid scales. Head elongate, quadrangular. Mouth wide, oblique, the lower jaw projecting; teeth small, in single scries, none on vomer or palatines. Eyes very small, or radimentary. Dorsal fin single, continuous, about 6 of its anterior rays simple; caudal fin pointed, more or less joined to the dorsal and anal; ventral fins united. Air bladder very small or absent. No pseudobranchiæ. Vertebræ 11 + 20. Pacific Ocean. (τοντλαστης, a mud-dabbler.)

## 996. T. sagitta Giinther.

Grayish, sides and below silvery; an ovate gray spot before each dorsal ray; caudal gray. Body and head elongate, compressed, the length of the latter two-thirds the distance between the base of the ventral and the vent. Maxillary reaching to behind eye; teeth sub-

horizontal, very small. Scales becoming larger posteriorly. Caudal arrow-shaped, about one-fourth length of rest of body; pectoral as long as ventral, half as long as head. Head  $5\frac{3}{5}$  (7 in total with caudal); depth  $9\frac{3}{5}$  (12 with caudal). D. VI, 21; A. I, 20. L.  $9\frac{1}{2}$  inches. "California." (Günther.)

(Amblyopus (Tyntlastes) sagitta Günther, Proc. Zoöl. Soc. Lond. 1862, 193.)

# FAMILY CV — CHIRIDÆ \*

## (The Chiroids.)

Cottoid fishes, with the body elongate, covered with small scales, which are either etenoid or cycloid; head more or less conical, scaly, without armature above; preopercle sometimes armed; top of head without spinous ridges, but usually with dermal flaps; a bony stay across the cheeks from the suborbital. Mouth large or small, with teeth on jaws, and usually on vomer and palatines; teeth various. Gills 4, a considerable slit behind the fourth; gill-membranes free or variously attached. Branchiostegals 6 or 7. Pseudobranchiæ present. Dorsal fin elongate, continuous or divided, the anterior half or more composed of spines; anal fin elongate, with or without spines; ventrals I, 5; some or all of the soft rays branched. Pyloric cæca few or many. Lateral line present; sometimes several lateral lines. Carnivorous fishes of the North Pacific. Genera, 8 or 9 known; species about 15.

(Triglidæ, group Heterolepidina Günther, ii, 90-95; genera Chirus, Ophiodon, Agrammus, and Zaniolepis.)

- a. Lateral lines 4 or more on each side; anal spines obsolete; mouth moderate; jaws with an outer series of stronger teeth, but no canines. (Chiring.)
  - b. Gill-membranes broadly united, free from the isthmus; scales mostly etenoid.

    HEXAGRAMMUS, 351.
- aa. Lateral line single on each side.
  - d, Gill-membranes free from the isthmus; preoperele armed.

    - ce. Anal spines 3, strong; scales ctenoid; mouth small, without eanines.

<sup>\*</sup>The Chiridae, Scorpanidae, Cottidae, Agonidae, Triglidae, Liparididae, and Cyclopteridae from a closely-related series (Cataphracti), and are distinguished from all the other Acanthopteri by the presence of the suborbital stay. Different writers have widely separated some of the members of this group from the others, but the relations of each, especially of the Scorpanidae, Agonidae, and Liparididae, with the Cottidae are so close that it is difficult to draw satisfactory boundary lines.

- f. Gill-membranes scarcely united; spinous dorsal greatly elevated in front; scales very rough. (Zaniolepiuw)..........ZANIOLEPIS, 353.
- dd. Gill-membranes united to the narrow is(hmus; preopercle unarmed; anal spines weak or obsolete.
  - g. Dorsal fins connected. (Agrammina.)
    - h. Anal\* comparatively short, its rays about 12; palatine feeth present. Myriolepis, 355.

### 351.-HEXAGRAMMUSt Steller.

#### Rock-trout.

(Chirus Steller: Labrax Pallas: Acantholebius Gill: Chiropsis Girard.)

(Steller; Tilesius, Act. Acad. Petropol. ii, 335, 1810: type Heragrammus asper Steller.)

Body oblong, somewhat compressed. Head subconical, blunt in profile. Mouth rather small, horizontal; jaws with bands of moderate-sized, conical teeth, the outer row enlarged; teeth on vomer, and usually a small patch on the palatines; preopercle unarmed; a fringed

#### GRAMMATOPLEURUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila, 1861, 166; type Labrax lagocephalus Pallas.

Distinguished from Hexagrammus by the cycloid scales. ( $\gamma \rho \alpha u u \eta$ , line;  $\pi \lambda \varepsilon v \rho \sigma v$ , side.)

G. lagocephalus (Pallas) Gill.

Five lateral lines; month rather small; color golden-brown. D. XX-24; A. 22. Knrile Islands.

(Labrax lagocephalus Pallas, Mém. Acad. Petersb. ii, 384, 1810; Chirus lagocephalus Günther, ii, 92.)

## OCTOGRAMMUS Bleeker.

(Bleeker, Versl. At. Amst. vi, 1370: type Labrax octogrammus Pallas = Octogrammus pallasi Bleeker.)

Distinguished from *Heragrammus* by the union of the gill-membranes to the isthmus(?). (ομτo, eight; χραμμη, line.)

O. pallasi Bleeker.

Olivaceous; back and sides spotted; belly yellow; pectorals hyaline; ventrals black at tip: four lateral lines; mouth moderate; scales strongly ctenoid; body elongate; dorsal deeply notched. "Flabella branchio stega divisa." D. XIX; A. 24. Kamtschatka and Aleutian Islands.

(Labrax octogrammus Pallas, 1. c. 393: Chirus octogrammus Günther, ii, 92; Bleeker, 1. c.; = Hexagrammus decagrammus?)

Bull. Nat. Mus. No. 16——41

<sup>\*</sup>Anal rays about 20 in Agrammus schlegeli, a Japanese species.

<sup>†</sup>The following species from the coast of Kamtschatka, related to *Hexagrammus*, have been made the types of distinct genera. These genera may be valid, if the characters assigned are correct, which is doubtful:

supraorbital cirrus. Gill-membranes broadly connected, free from the isthmus; gill-rakers short, tubercle-like. Scales small, mostly ctenoid. Head more or less scaly, without spines. Lateral lines usually 5 on each side. Dorsal fin long, sometimes with a deep emargination between the spines and the soft rays; dorsal spines slender, 19–22 in number; anal fin elongate, with a single rudimentary spine; rays of pectorals and anal exserted and almost simple; pectoral rounded, with broad, procurrent base, the rays thick; ventrals well developed, placed at a considerable distance behind the root of the pectorals; caudal subtruneate. Branchiostegals 6. Pyloric cœca numerons (about 13). No air-bladder. Species of rather large size and bright coloration; abundant in the North Pacific. ( $\xi \bar{\xi}$ , six;  $\gamma \rho \alpha \mu \rho \eta$ , line.)

a. Dorsal fin continuous, or but slightly emarginate. (Pleurogrammus\* Gill.)

## 997. H. monoptervgius (Pallas) J. & G.

Dark olive above, yellowish below, the color of the back forming several broad cross-bars on the sides; fins dusky, nearly plain; the pectoral with blackish margin; ventrals blackish. Body rather stont, little compressed. Mouth moderate, the maxillary extending to below the front of the large eye. Teeth in the jaws in bands, the outer series somewhat enlarged and recurved; teeth on vomer, and a few asperities on the palatines. Supraocular cirri small. Cheeks partly naked; opercles well scaled; scales small, all rough. Five lateral lines, the fourth of these ceasing on the belly. Dorsal fin high and continuous; pectoral rather large; ventrals long, inserted behind the pectorals at a distance of twice the diameter of the eye. Head 4½; depth 4. D. XXI-25; A. 24. Coast of Alaska; not rare.

(Labrax monopterygius Pallas, Mém. Ac. Sci. Petersb. ii, 391, 1810, and in Zoogr. Rosso-Asiat. iii, 281: Chirus monopterygius Günther, ii, 92.)

#### 998. H. ordinatus (Cope) J. & G.

"Dorsal fins not very elevated, continuous, but with a slight depression at the point of union of the two; a dentate flap above each eye; lateral lines of pores 5, only three of which extend to the basis of the caudal fin, viz, the second, third, and fifth; the first extends to opposite the middle of the second dorsal; the fourth commences below and in front of the basis of the pectoral, and extends to a point a little behind that measured by the extremity of that fin; the inferior series of opposite sides converge and unite a little behind the basis of the ventrals

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: type Labrax monopterygius Pallas.

into a single median line, which extends to the branchiostegal fold. Radii Br. VI; D. XIX-25; C. 17, the interspaces scaled; the margin nearly truncate: A. 26; V. I. 5; P. 18. Head scaled above and on sides, except on interoperculum and muzzle. Scales etcnoid, 13-94-34. The scales are elongate, and nearly truncate distally; on the sides they are in oblique series, but near the dorsal fin from 3-5 rows exhibit General color pale-orange, with illscales superposed vertically. defined blackish shade on the sides, and 7 quadrate-blackish spots at the base of the dorsal fin; below, bright yellow; dorsal and candal fin vellowish at base, margins with a broad blackish band; 3 black spots on the middle of the first, and 4 on the middle of the second dorsal fin; anal yellow, with 7 blackish blotches extending anteriorly across the rays; pectoral yellow, with brown spots on the rays and a black one at the base in front; eye with 5 blackish radii, diverging, two anteriorly, one upward and backward, one backward, and one downward and back-Total length 14 inches; length of head entering it 4.33 times; depth of body 4 times in the same; eve 5 times in head, 1.66 times in muzzle, and 1.25 times in interorbital width." Coast of Alaska. (Cope.) (Chirus ordinatus Cope, Proc. Amer. Phil. Soc. Phila. 1873.)

aa Dorsal fin with the spines separated from the soft rays by a deep notch. (Hexagrammus.)

- b. Checks partly naked.
  - c. Scales all strongly ctenoid.

## 999. II. asper Steller.

Light or dark greenish, much mottled with blackish, rusty-red, and light blue, the dark color in the form of fine marblings, the reddish in the form of broad washes, and the bluish as roundish spots; two lightblaish bands downward and forward from eye, separated by a blackedged brown area; a whitish streak and various reticulate markings on cheeks and opercles; pectorals and dorsal mottled with brown spots; a dark humeral spot, distinct in the young; lower fins black in the male, pale in the female; flesh often tinged with green. Form rather Maxillary reaching past front of eye, about to pupil. No teeth on palatines. Scales all strongly ctenoid, except on sides of head; region about suborbital stay and lower part of the opercles naked or nearly so; lower part of cheeks scaled in varying degree, generally more naked in large examples. A lateral line from occiput close to dorsal fin, ceasing near middle of spinous dorsal; one from occiput along back to base of caudal; one from angle of operele to middle of base of caudal; one from just below the pectoral fin, undulating along the sides of the abdomen, ceasing in front of tips of ventrals; one beginning on the median line of the breast, forking near the middle of the ventrals, the branches going straight to the lower part of the tail. Dorsal high, less deeply emarginate than in the following species; the spines high; caudal slightly emarginate; supraocular tentacles moderate, about as long as pupil; sexes not very dissimilar. Head  $3\frac{1}{3}$ ; depth  $4\frac{1}{3}$ . D. XXII-I, 20; A. 23; Lat. l. 110. Alaska, south to San Francisco and Japan; abundant.

(Steller, MSS. Tilesius, Act. Acad. Petrop. ii, 340, 1810: Labrax hexagrammus Pallas, Zoogr. Rosso-Asiat. iii, £84, 1811: Chirus hexagrammus Günther, ii, 91: Chiropsis nebulosus Girard, U. S. Pae. R. R. Surv. Fish. 45, based on a specimen with some of the soft rays of the dorsal broken, resembling spines: Chirus nebulosus Günther, ii, 93: Acantholebius nebulosus Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: Chirus trigrammus Cope, Proc. Amer. Phil. Soc. Phila. 1873: Hexagrammus scaber Bean, Proc. U. S. Nat. Mus. 1881, 154; based on very young specimens, showing a rudimentary additional lateral line along middle of side.)

cc. Scales mostly cycloid posteriorly; dorsal very deeply emarginate.

## 1000. II. superciliosus (Pallas) J. & G.

Blackish-green, varying to dark brown and cherry-red, the coloration and pattern extremely variable; sides usually with round pale spots, which are generally cherry-red, especially in the adult, but which are sometimes nearly white and often obsolete; belly mostly reddish; pectorals greenish or red, usually with 2 or 3 dusky crescent-shaped cross-bands at base, the outer portion often plum-color; fins mostly greenish or red, variegated; lower fins mostly dusky; flesh, and all membranes, livid green, especially in the adult; stomach and intestines of a livid green. Body rather robust. Orbital tentacle much larger than in other species, its length 3 the diameter of the eye. A few teeth on front of palatines. Skin covering suborbital stay naked; cheeks otherwise scaly. Scales ctenoid on body anteriorly, becoming nearly smooth behind and on head. Lateral lines 5; one on the middle line from the nape, forking, and extending on each side nearly to end of second dorsal; the second to the upper edge of the caudal; one to the middle line of the tail; one from throat to about middle of anal; and one on the middle line of the belly, forking behind the ventrals, and extending on each side to the tail. Dorsal deeply emarginate. Caudal truncate or slightly rounded; pectorals large. Sexes similar. Head 4; depth 33. D. XX-23; A. 22; Lat. I. 107. L. 18 inches. Alaska to Monterey; not rare.

(Labrax superciliosus Pallas, Mem. Acad. Petersb. ii, 388, 1810, and in Zoogr. Rosso-Asiat. iii, 279: Chirus pictus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 132: Chiropsis

pictus Grd. U. S. Pac. R. R. Surv. Fish. 43: Chirus pictus Günther, ii, 93: Chirus pictus Lockington, Proc. U. S. Nat. Mus. 1880, 54: Chirus balias Cope, Proc. Amer. Phil. Soc. 1873.)

bb. Cheeks wholly sealed; scales all etenoid.

### 1001. H. decagrimmus (Pallas) J. & G.—Rock Trout; Boregat; Bodieron.

Males clear brownish-olive of varying shade, often tinged with bluish or coppery and vaguely blotched; often with small blue spots; head and anterior part of body with rather large sky-blue spots, each surrounded by a rusty ring, these smaller and more numerous on the top of the head; lips with bluish spots; upper fins brown, mottled; ventrals and anal dusky-bluish; pectorals dark, both rays and membranes crossed by sharply-defined whitish reticulations, so that the fins appear to be profusely spotted with white. Females brownish, somewhat tinged with reddish, closely covered with round spots of a reddish-brown; these spots usually quite small and uniform over the whole back and sides: dorsal fin spotted on the scaly part, the fins otherwise plain reddish or bluish, the ventrals usually dusky; pectorals light orange, without markings. Other females ("maculoseriatus") have the ground color slatyblue, with rows of round orange spots considerably larger than usual, and becoming vermiculations on the head; dorsal fin orange, clouded at base with blue; soft dorsal edged with bluish; pectorals plain orange; belly white. Body elevated at the shoulders, descending rather steeply at the nape. Maxillary not reaching middle of eye; a very few teeth on front of palatines; supraocular flap smaller than in other species, shorter than pupil. Cheeks and opercles entirely scaled; scales on the body all strongly ctenoid. Uppermost lateral line forking on the nape, the branches running to opposite the middle of the second dorsal; the second lateral line to upper edge of tail; the third to middle of tail; the fourth to a little beyond the middle of anal; the fifth to lower edge of tail; the fourth beginning near the lower edge of the pectorals and undulating opposite the ventrals, the lowermost on each side joining just in front of the vent, and proceeding on the median line to the middle of the breast. Dorsals high, scarcely connected; pectorals and ventrals large; candal slightly emarginate. Head  $4\frac{1}{5}$ ; depth 4. XXI-24; A. I, 23; Lat. I. 112. L. 18 inches. North Pacific; abundant from Point Concepcion to Alaska.

(Labrax decagrammus Pallas, Mém. Acad. Petersb. 1810, ii, 386, ♀, and in Zoogr. Rosso-Asiat. iii, 278: Chirus decagrammus Günther, ii, 92: Chirus guttatus Girard, Proc. Acad. Nat. Sci. Phila. 4854, 132: Chiropsis guttatus Grd. U. S. Pac. R. R. Surv. Fish.

44: Chiropsis constellatus Girard, U. S. Pac. R. R. Surv. Fish. 42,  $\beta$ : Chirus constellatus Giinther ii, 92: Chirus guttatus, constellatus, and maculoseriatus Lockington, Proc. U. S. Nat. Mus. 1880, iii, 53-55: Grystes lineatus ( $\beta$ ) Ayres, Proc. Acad. Nat. Sci. i, 9, 1854: ? Labrax octogrammus Pallas, Zoogr. Rosso-Asiat. 283.  $\mathfrak P$ .

#### 352.—OPHIODON Girard.

(Oplopoma Girard.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 133: type Ophiodon elongatus Girard.)

Body elongate, low, little compressed. Head long, rather pointed, its surface sealeless. Mouth terminal, very large. Jaws with very strong, sharp, unequal teeth, some of them canine-like; long series of cardiform teeth on vomer and palatines. Gill-openings very wide, the membranes not united, free from the isthmus. Preopercle with a few bluntish spines; a dermal flap above the eye. Scales very small, becoming smooth with age. Lateral line single, continuous. Dorsal fin long, deeply notched, the spines about 24 in number, slender and flexible, the middle ones highest; anal fin long, without distinct spines; ventrals, I, 5, inserted somewhat behind pectorals; pectoral fin broad. Pyloric cœca very numerous. Gill-rakers tubercle-like. Species of large size; among the largest of the cottiform fishes. (optis, snake; odov, tooth.)

## 1002. O. clongatus Grd .- Cultus Cod: Blue Cod; Buffalo Cod; Ling.

Dark brown above, much mottled; dorsal fin and whole upper part of body covered with small rusty brown spots of varying size and hue; lower parts of body of a livid bluish green, especially in the adult, the flesh and all membranes tinged with green; ground color often bluish or reddish tinged; young sometimes bright green; fins dusky, mottled, the dorsal and caudal with a very narrow, pale edging. Head large, the snout sharp, conic. Mouth very large, the lower jaw prominent; maxillary reaching beyond orbit; each jaw with a series of large pointed teeth, bent inward and immovable; front of upper jaw with 2-4 larger canines; outside of the series of large teeth each jaw has numerous small, sharp teeth; vomer and palatines with a single row of canines; supraorbital tentacle much shorter than pupil. Dorsal fin beginning above preoperele, the fin very deeply notched, the highest spines nearly one-third length of head; caudal emarginate. Head 3½; depth D. XXV-21; A. 22. L. 40 inches. Pacific coast, Alaska to Santa Barbara; very abundant, reaching a weight of 30-40 pounds, being one of the most important food-fishes on the coast.

(Cirard, Proc. Acad. Nat. Sci. Phila. 1854, 133; Girard, U. S. Pac. R. R. Surv. Fish. 48; Günther, ii, 94: Oplopoma pantherina Girard, Proc. Acad. Nat. Sci. Phila. 1856, 135, and in U. S. Pac. R. R. Surv. Fish. 46: Ophiodon pantherinus Günther, ii, 93.)

#### 353.-ZANIOLEPIS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1857, 202: type Zaniolepis latipinnis Grd.)

Body elongate, little compressed, tapering from the nape to the long and slender tail. Head short, conical, the profile decurved. Mouth rather small, low, terminal, horizontal; eardiform teeth on the jaws, vomer, and palatines; no supraorbital cirri; preopercle with spines. Gill-membranes not united, free from the isthmus; gill-rakers tubercle-like. Scales small, imbricated, extremely roughly ctenoid. Lateral line single, continuous. Dorsal fin with about 21 spines; some of the anterior spines greatly elevated; a deep notch between the spines and soft rays; anal fin very long, with 3 spines, the second of which is longest; ventrals I, 5, long, inserted a little behind pectorals; pectorals moderate. Pyloric cœca few (5 or 6). North Pacific, in deep water: (ξαντον, a comb or card; λεπτε, scale; hence more correctly spelled with an initial X.)

# 1003. Z. latipinnis Grd.

Olivaceous, the body and upper fins spotted with rusty brown; the vertical fins marked with blackish; a black streak before eye; suborbital bluish silvery. Body elongate, fusiform, searcely compressed, the dorsal outline rising rather steeply. Mouth small, horizontal, low, the maxillary reaching nearly to the middle of the eye; the premaxillary entirely below the eye. Eye very large, longer than snout, 31 in head; preorbital wide, partly covering the sealy maxillary; interocular space rather narrow, somewhat concave; nasal spines present; preopercle with 3 sharp spines. Dorsal spines slender, stiff, the first and second longest, usually greatly produced, but stiffish to the tip, scarcely connected by membrane, reaching to nearly middle of second dorsal, and more than half the total length of the fish, but often much shorter; a deep notch between spinous and soft parts of dorsal; second dorsal high, its rays gradually shortened; anal long, its spines high; ventrals elongate, wide apart, reaching past front of anal; pectorals short and narrow; caudal short, slightly emarginate. Head and body everywhere covered with minute, imbricated, very rough, shagreen like Head  $4\frac{1}{3}$ ; depth  $5\frac{1}{4}$ . D. XXI-I, 11; A. III, 17. L. 12 inches. scales. California, from San Francisco northward, abundant in deep water; a slender fish, of dry, firm substance.

(Girard, Proc. Acad. Nat. Sci. Phila. 1857, 202; Girard, U. S. Pac. R. R. Surv. Fish. 73; Günther, ii, 94.)

#### 354.—OXVLEBIUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 277: type Oxylchius pictus Gill.)

Body oblong, somewhat compressed. Head conical, very slender, acuminate, the profile somewhat concave. Mouth small. Jaws each with a band of teeth, the outer series considerably enlarged; minute teeth on vomer; few or none on palatines. Top of head with dermal flaps. Preopercle with 2 blunt spines. Gill-membranes broadly connected, free from the isthmus; gill-rakers short, not very stout. Scales small, etenoid. A single lateral line. Dorsal fin emarginate, with about 16 low, rather strong spines; soft dorsal moderate, its membrane closely scaled; anal with 3 stout spines, the second the longest; candal truncate; pectorals rather long, their bases not procurrent; ventrals moderate, inserted well behind pectorals. Pyloric cocca few. Small fishes, of bright coloration.  $(o\xi o \varepsilon, \text{ sharp}; \lambda \varepsilon, \beta \iota a \varepsilon - Lebius, \text{ an old synonym of } Hexagrammus, \text{ from } \lambda \varepsilon, \beta \iota a \varepsilon, \alpha \varepsilon + Lebius, \text{ an old synonym of } Hexagrammus, \text{ from } \lambda \varepsilon, \beta \iota a \varepsilon, \alpha \varepsilon + Lebius, \text{ an old synonym of } Lesion cooked in \lambda \varepsilon, \beta \iota \alpha \varepsilon, \alpha \varepsilon + Lebius, \alpha \varepsilon + Lebius,$ 

## 1004. O. pictus Gill.

Tawny gravish, with about 6 black bars, alternating with areas of pale orange, the latter obscured by dusky spots and blotches; the dark bars extending on the fins, the first across the nape, the second across the middle of the spinous dorsal, the third broader, across posterior part of spinous dorsal and front of anal; one across middle of soft dorsal, one on posterior part, and one at base of caudal; the bars are about as wide as the interspaces, and their edges are irregular, but sharply defined; pectorals and caudal orange, with cross-series of spots; ventrals largely black; under side of head orange, freckled, spotted with pale; 2 fringed cirri over each eye, scarlet; breast and belly marbled. Body rather deep, compressed. Head little compressed, slender, pointed; lips thick; lower jaw slightly included; maxillary small, barely reaching eye. Eyes large, about equal to snout, 4 in head; nasal spines present; interocular space Scales on sides of head very small; scales on body small, ctenoid, with strong horizontal striæ, those on breast minute. Dorsal fin continuous, its spines stiff, the middle ones highest, and all considerably lower than the soft rays; second anal spine longer than the third, about equal to the soft rays; pectorals barely reaching anal; ventrals to past vent. Head  $3\frac{1}{3}$ ; depth  $3\frac{1}{3}$ . D. XVI-15; A. III, 13. L. 10 inches. Rocky shores, from Monterey northward; rare. A most beautiful and active little fish.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 277.)

#### 355 .- MYRIOLEPIS Lockington.

(Lockington, Proc. U. S. Nat. Mus. 1880, 248: type Myriolepis zonifer Lockington.)

Body oblong, somewhat compressed. Head heavy. Mouth moderate, the lower jaw slightly projecting; both jaws with bands of slender, sharp teeth, the front teeth slightly enlarged; similar teeth on vomer and palatines; preopercle entire; no dermal flaps. Gill-rakers short; gill-membranes very narrowly joined to the isthmus. Scales small, etenoid, everywhere covering the head and body and the soft parts of most of the fins. Lateral line single. Dorsal fin deeply emarginate; the spines about 15 in number. Anal rather short, without distinct spines. (μοριος, many; λεπις, scale.)

## 1005. M. zonifer Lockington.

Black above, whitish below, with four broad black bars on the sides: the first over the pectorals; the second anterior to the vent, almost encircling the body; the third near the base of the anal, and the fourth encircling the caudal peduncle; a black bar at base of caudal and two across the fin; other fins blotched and banded with light and dark: ctenoid tips of the scales white. Head everywhere densely scaly, the only naked areas on the head being the lips and the folds of the gillmmebranes. Scales on body largest posteriorly, small on head and chest. Vertical fins, except the spinous dorsal, covered nearly to the tips of the rays with small scales; external surfaces of paired fins similarly scaly; spinous dorsal with a few scales. Pectorals broad, lanceolate, not reaching the vent; fourth dorsal spine longest, the others diminishing regularly to the 12th. Eyes lateral, shorter than snout; interorbital space broad, slightly convex. Head 4 in total length; depth 32. D. XIV-I, 15; A. II, 11; Lat. l. 130. Monterey Bay, California; one specimen known.

(Lockington, Proc. U. S. Nat. Mus. 1880, 248.)

# 356.—ANOPLOPOMA Ayres.

(Scombrocottus Peters.)

(Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 27: type Anoplopoma merlangus Ayres = Gadus fimbria Pallas.)

Body elongate, little compressed, tapering into a very slender caudal peduncle. Head rather long, the snout somewhat tapering. Mouth terminal, moderate, the lower jaw included; maxillary very narrow, slipping almost entirely under the preorbital; teeth moderate, cardiform,

those in the lower jaw in a single series laterally, and in a narrow band in front; upper jaw, vomer, and palatines each with a band of similar teeth. Head entirely scaly. No supraorbital flap. Preopercle unarmed, its membranaceous edge crenulate. Gill-membranes joined to the isthmus. Body entirely covered with minute ctenoid scales. Lateral line single. Dorsals short, well separated, the first of slender, flexible spines; second dorsal shorter, similar to the anal, which is preceded by three weak spines; ventrals but little behind pectorals; caudal fin forked. Peritoneum black. Pyloric cœca about two, long and slender. Gill-rakers slender, few, not very short. North Pacific. ( $\alpha 20\pi \lambda 05$ , unarmed;  $\pi \tilde{\omega} \mu a$ , operculum.)

### 1006. A. fimbria (Pallas) Gill.—Beshow; Coal-fish.

Color slaty-black or grayish, somewhat reticulated; white below, the young rather pale; adult nearly black; fins dusky; caudal edged with pale; lining of the opercle black. Premaxillaries on the level of the lower part of the orbit; maxillary reaching to opposite front of pupil. Dorsal fins separated by a distance nearly equal to two-thirds length of the base of soft dorsal, the spines very weak; the fourth longest; pectorals reaching beyond tips of ventrals, not half way to vent. Head 4; depth 6½. D. XX-I, 17; A. III, 15; Lat. l. 190. Usual length 18 inches, but sometimes much larger. Monterey to Alaska; rather common, especially northward. A very singular and interesting fish.

(Gadus fimbria Pallas, Zoogr. Rosso-Asiat, iii, 200, 1811: Anoplopoma merlangus Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 27: Scombrocottus salmoneus Peters, Berlin. Monatsber.)

# FAMILY CVI—SCORPÆNIDÆ.

# (The Rock-fishes.)

Cottoid fishes, with the body oblong, more or less compressed, the head generally large, and usually with one or more pairs of ridges above, which terminate in spines. Opercle usually with two spinous processes; preopercle with five. Mouth terminal, usually large, with villiform teeth on jaws and vomer, and usually on the palatines. Premaxillaries protractile; maxillary broad, without supplemental bone, not slipping under preorbital. Gill-openings wide; the gill-membranes separate and free from the isthmus; usually no slit behind the fourth gill. Scales etenoid, or sometimes eyeloid, usually well developed, sometimes nearly obsolete. Lateral line single. A bony stay extending backward from the suborbital toward the preopercle. Ventral fins thoracic, of the normal percoid form, I, 5, the rays branched; dor-

sal with 8 to 16 rather strong spines and about as many soft rays; anal rather short, with 3 spines and 5-10 soft rays; soft rays in all the fins branched, except some of the lower rays of the pectorals. Pyloric ecca in moderate or small number (less than 12). Pseudobranchiae large. Air-bladder present. Genera about 20; species about 200, inhabiting all seas, but especially abundant in the temperate parts of the Pacific Ocean, where they form a large proportion of the fish fauna. They are non-migratory fishes living about rocks; most of them are of large size, and all are used as food. Many of them are viviparons, the young being produced in great numbers when about one-fourth of an inch in length.

(Triglidae, group Scorpanina pt. Günther, ii.)

#### 357.-SEBASTES Cuvier.

# Rose-fishes.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type Perca norregica Müller.)

Body oblong, compressed. Head large, scaly above and on sides; cranial ridges well developed. Month terminal, very broad, oblique, the broad maxillary extending to below the eye; lower jaw projecting, with a bony knob at the symphysis; palatine teeth present. Eye very large; preopercle with five divergent spines; opercle with two; suprascapular spines strong; gill-rakers long, slender. Scales small, etenoid, irregularly arranged; no dermal flaps. Dorsal fin continuous, very long, the spinous part much longer than the soft part, of 15 strong spines; anal spines three, strong; caudal emarginate; pectorals long, narrow. Branchiostegals 7. Vertebre 12 + 19. Coloration mostly red. Ovoviviparous. Species few, mostly of the Northern Seas.  $(\sigma \epsilon_i \beta a \sigma \tau \delta \epsilon_j$ , magnificent.)

## 1007. S. marinus (L.) Lütken.-Rose-fish; Red-fish; Snapper: Hemdurgan.

Orange red, nearly uniform, sometimes a dusky opercular blotch, and about 5 vague dusky bars on the back. Body ovate; back clevated, the ventral outline straightish; top of head evenly scaled; interorbital space with two low ridges, between which it is concave; masal spines present; cranial ridges moderate, rather low and sharp; preocular, supraocular, postocular, tympanic, and occipital ridges present, the latter with the tips abruptly divergent; suprascapular spines very sharp

and prominent: opercular spines long and sharp; subopercular spine prominent: preopercular spines slender and sharp, the second longest: suborbital stay not reaching preopercle: preorbital narrow, with two spines. Eve exceedingly large, 3 in head, more than twice as wide as interorbital space. Mouth very large, oblique: maxillary very broad, reaching middle of eye, its length 24 in head; premaxillaries on level of middle of pupil; tip of lower jaw much projecting, with a conspicuous, pointed symphyseal knob; mandible and maxillary scaly; pseudobranchiæ very large; gill-rakers long, stiff and strong, about as in Sebastodes pinniger. Dorsal spines sharp, the longest about as long as eye; the fin deeply emarginate; soft rays not very high, higher than the spines; caudal narrow, moderately forked; anal spines moderate, graduated; the second a little shorter than eye; pectoral rather long, reaching vent, its base narrow; ventral reaching to vent. Scales small, irregular, not strongly etenoid. Peritoneum brownish. Head 3; depth 2\frac{1}{2}. D. XV-13; A. III, 7; Lat. l. 40 (tubes); scales about 85. Atlantic coasts of America and Northern Europe, south to Cape Cod.

(Perca marina L. Syst. Nat. x, 1758, in part: Perca norwegica Müller, Zoöl. Dan. 46: Sebastes norwegicus Günther, ii, 95.)

Subsp. viviparus (Kröyer) Lütk.

General color brownish red, somewhat mottled, with a blackish blotch on the opercle, and some other brownish spots on the body. Pectoral fins a little longer than in *S. marinus*; interocular space rather narrower. Head 3½; depth 3½. D. XV-14; A. III, 8. Arctic Seas, south to Cape Cod and the Baltic; smaller than the preceding and living near shore; thought to be a littoral variety.

(Sebastes viviparus Kröyer, Naturhist. Tidsskr. i, 275, 1844-'45; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 333: Sebastes viviparus Günther, ii, 96.)

#### 358.—SERASTODES\* Gill.

Rock-fish; "Rock Cod."

(Sebastichthys, Sebastoplus, Sebastomus and Sebastosomus Gill.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 165: type Sebastes paucispinis Ayres.)

Body oblong or elongate, somewhat compressed; head large; mouth

<sup>\*</sup>A very doubtful species, which may be the young of Sebastes marinus, with an abnormal number of spines, is accredited to our Atlantic coast, viz: S.? fasciatus (Storer.)

<sup>&</sup>quot;Body elongated, not convex in front of dorsal fin as in Schastes norvegiens; four distinct dark brown transverse bands upon the sides, the broadest at the posterior portion of the body." D. XIII-14; A. III, 7. Provincetown, Mass. (Storer.)

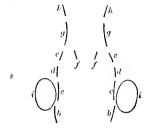
<sup>(</sup>Schastes fasciatus Storer, Proc. Bost. Soc. Nat. Hist. v, 31, 1854: Schastes? fasciatus Gill, Proc. Acad. Nat. Phila. 1863, 335.)

moderate or large, with the jaws equal or the lower more or less proiecting; teeth in villiform bands on jaws, vomer and palatines. Head more or less evenly scaled, without dermal flaps; cranial ridges more or less developed; \* some or all of the following pairs present, usually ending in spines: preocular, supraocular, postocular, tympanic, coronal, occipital, and nuchal. Five preopercular spines. Two spines on the opercle and one to three on the suprascapula. Suborbital stay moderate, usually not reaching preopercle. Gill-rakers various. Scales moderate or rather small, etenoid, in 45 to 100 transverse series. Dorsal fin continuous, emarginate, its formula XIII, 12 to 14. Anal fin III. 6 to 9. Pectorals well developed, the base broad or narrow, the lower rays undivided. Caudal truncate or slightly forked; soft parts of vertical fins more or less scaly. Pyloric ceca 6 to 11. Vertebrae 12 + 15. Species of rather large size, and varied, often brilliant colors, mostly red. Sexes colored alike. Most of them inhabit the Pacific Ocean, and they are exceedingly abundant in rocky places along the west coast of the United States. All are ovoviviparous, bringing forth great numbers of young, which are nearly half an inch in length when The species differ greatly in form and armature, but the genera based on these differences intergrade too closely to be worthy of retention. (σεβαστός, Sebastes; ειδος, likeness.)

#### ANALYSIS OF SPECIES OF SEBASTODES.

a. Scales very small; lat. l. 90-100; mouth very large, the lower jaw much projecting; skull thick, the cranial ridges weak. A. III, 9. (Sebastodes.)
 Color light olivaceous red; young greenish....paucispinis.

\* Diagram of cranial ridges of Sebastodes.



 $a \setminus a$ 

- a. Nasal spines.
- b. Preocular spines.
- c. Supraocular spines.
- d. Postocular spines.
- e. Tympanic spines.
- f. Coronal spines.
- g. Occipital spines.
- h. Nuchal spines.
- i. Eyes.

- aa. Scales small; lat. l. 65 to 80; anal rays III, 7 to III, 9; skull thick, cranial ridges very low or obsolete; lower jaw much projecting; gill-rakers very long and slender; candal emarginate; jaws scaly. (SEBASTOSOMUS Gill.)
  - b. Peritoneum white: cranial ridges all obsolete.
    - c. Color olivaceous, nearly plain; caudal yellowish or greenish; mouth large.

      \*flavidus.\*
  - cc. Color dusky, sides spotted with black; caudal dark; mouth smaller..melanops. bb. Peritoneum black.
    - d. Supraocular and occipital ridges obsolete, without spines; colors dusky, the fins blackish.

      - ee. Precentar ridges present, usually ending in spines, the frontal region between them bulging.. mystinus.
    - dd. Supraocular and occipital ridges mostly present, ending in spines; dorsal fin not deeply emarginate; soft dorsal low.

      - ff. Second anal spine notably longer than third.
        - g. Body ovate; postocular spines present; color chiefly creamy or olivaceous ......oralis.
- gg. Body rather elongate; postocular wanting; color chiefly red. proriger. aaa. Scales moderate; lat. l. 45 to 60; anal rays III, 5 to III, 7.
  - h. Cranial ridges very low, the skull thick and solid; lower jew little projecting; interorbital space convex; gill-rakers slender, usually long.
    - i. Color olivaceous; postocular spine wanting; mandible with a few smooth scales ......atrovirens.
    - ii. Color red; postocular spine present.
      - j. Scales on mandible smooth; color chiefly orange.....pinniger.
    - jj. Scales on mandible very rough; color chiefly brick-red.. miniatus.
  - hh. Cranial ridges more or less strong; skull comparatively thin; gill-rakers generally short.
    - k. Postocular and tympanic spines both present; interorbital space concave. (Sebastomus Gill.)
      - Cranial ridges broken and armed with accessory spines (in the adult, nearly smooth in young); second anal spine searcely longer than third; color red, nearly plain..ruber.
      - U. Cranial ridges smooth; second anal spine much longer than third; color rosy, with three or four round blotches of pink on sides of back.
        - m. Dorsal spines low, the highest less than half the length of head.
          - n. Body everywhere with small round pale spots.

constellatus.

nn. Body without stellate spots.

o. Pale blotches on sides surrounded by purple shades; head with purplish above; mandible paked resuress

oo. Pale blotches on sides surrounded by green shades; no purple; cranial ridges very share; mandible partly scaly.

rhodochlovis.

mm. Dorsal spines very high, the highest half the length of head; body above with many small round green spots.

chlorostictus.

kk. Postocular spine wanting.

pp. Mandible naked; peritoneum white; body deep.

q. Scales on head mostly cycloid; lower jaw projecting; second anal spine much stronger than third; color pinkish white, banded with deep crimson.....rubrivinctus.

qq. Scales on head ctenoid; lower jaw usually included; second anal spine little enlarged. (Sebastichthys Gill.)

r. Coronal spines present; cranial ridges moderate; color brownish, mottled.

anriculatus.

rr. Coronal spines none.

s. Cranial ridges with entire edges.

t. Nuchal ridges none.

Gill-rakers extremely short, most of them
 as wide as high; general color
 dusky-greenish.... rastrelliger.

uu. Gill-rakers higher than wide.

v. Highest dorsal spine notably more than half length of head.

w. Head and upper parts not speckled with orange; membrane of spinous dorsal not very deeply incised.

x. Color dark brown, varied with light brown ......eaurinus.

xx. Color reddish, varied with yellowish; dorsal spines higher.

vexillaris.

ww. Head and upper parts everywhere speckled with orange; front of back yellowish; soft fins black; dorsal spines extremely high, their membranes deeply incised. maliger.

- vv. Highest dorsal spine little if any more than half the length of head.
  - y. Pale blotches on sides not forming a continuous lateral band; occipital ridges moderate.
    - z. Pale markings flesh-color; dark markings olivaceous...carnatus.
  - zz. Pale markings yellow; dark markings blackish...chrysomelas.
  - yy. Pale blotches on sides, forming a continuous lateral band; body and fins profusely speckled with pale; dark markings black; pale markings yellow; occipital ridges very strong...nebulosus.
- ss. Cranial ridges with the surface broken, spinous; frontal ridges elevated; color bright red, with black bands.....nigrocinctus.
- a. Species with very small scales (lat. l. 90-100); the cranial ridges little developed; the mouth very large, the lower jaw much projecting. (Sebastodes.)

# 1008. S. paucispinis (Ayres) Gill.—Boccaccio; Meron; Jack.

Pale dull orange red, dark brown above, the sides somewhat vaguely spotted; young olivaceous; fins nearly plain, lower reddish, upper dusky; tip of lower jaw dark. Body elongate, compressed, profile straight from the protruding tip of the lower jaw to the front of the dor-Head large, long, and narrow, pointed. Mouth much larger than in any other species, oblique, the broad maxillary reaching to beyond the eye; its length 13 in head; lower jaw very strong, with a projecting knob at tip, which protrudes farther than in any other species. Premaxillary on the level of lower edge of pupil. Cranial ridges little developed, the preocular and occipital traceable and sometimes ending in small spines. Interocular space broad, with two low ridges; top of head scaled to tip of snout; maxillary and preorbital scaly; preorbital with narrow neck and three small spines; suborbital stay moderate; preopercular spines sharp and diverging, the third largest, the lower often divided; opercular spines moderate. Gill-rakers slender, compressed, not very long. Eye large, 4-6 in head, slightly more than interorbital width. Scales very small and rough, irregular; accessory scales few. Dorsal spines low, rather slender, the fin deeply emarginate; longest spine  $\frac{2}{5}$  length of head, scarcely higher than the soft rays; caudal emarginate; anal low, its spines small, short, graduated, the second shorter than eye; pectorals narrow, rather long, not nearly reaching vent, the base  $\frac{3}{4}$  diameter of eye; ventrals shorter, not reaching tips of pectorals. Peritoneum white. Head  $2\frac{2}{3}$ ; depth  $3\frac{3}{4}$ ; pectorals 5. D. XIII-13; A. III, 9; Lat. l. with 65-80 tubes; about 100 scales in a longitudinal series. L. 30 inches. Coast of California; abundant in rather deep water.

(Schastes pancispinis Ayres, Proc. Cal. Acad. Nat. Sci. i, 6, 1854; Schastes pancispinis Grd. U. S. Pac, R. R. Surv. Fish, 83; Gill, Proc. Acad. Nat. Sci. Phila, 1861, 165; Ayres, Proc. Cal. Acad. Nat. Sci. 1832, 215; Schastes pancispinis Günther, ii, 98.)

aa. Species with scales small (lat. l. 60 to 70); cranial ridges little developed; skull thick; lower jaw strongly projecting; anal rays III, 7 to III, 9; jaws scaly; gill-rakers very long and slender. (Sebastosomus\* Gill.)

#### 1009. S. flavidus Ayres. - Yellow-tail Rock-fish.

Olive green, rather pale, plain or finely spotted with yellowish; fins olive, candal strongly tinged with yellow; young mottled. Body oblong, compressed, the back not much elevated. Head rather long, pointed. Month large, oblique, the maxillary extending to nearly opposite posterior margin of eye, 2 in head; premaxillaries in front on the level of lower margin of pupil. Lower jaw strongly projecting, its symphyseal knob very prominent, but less so than in S. paucispinis. Preorbital narrow, without spines. Top of head evenly scaled, the nasal spines only present and very small. Cranial ridges obsolete, without spines; only the occipital ridges visible under the scales. Interorbital space evenly convex. Preopercular spines rather strong, all of them directed strongly backwards; opercular spines moderate; suprascapular spines small, the upper obsolete. Scales medium; accessory scales variable. Dorsal spines low, slender, the longest 3 in head; the soft rays rather high, the fin very deeply emarginate, the membrane joining the thirteenth spine at about one-fourth its height; caudal fin notched; anal spines low, regularly graduated, the third spine less than half the height of the soft rays, the second as long as eye; pectoral fins shortish, rather broad, reaching tip of ventrals, but not quite to vent. Peritoneum white. Head 3; depth 3; pectoral 4. D. XIII-15; A. III, 9; Lat. l. about 60. L. 24 inches. Coast of California, abundant; an important food-fish.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1862, 209, f. 64.)

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1864, 147: type Sebastes melauops Grd. (σεβαστος, Sebastes; σωνα, body.)

# 1010. S. melanops (Grd.) Avres.

Olive brown, dark above, the sides paler: upper part of sides thickly marked with small slaty-black blotches; head blackish above; a dark streak on maxillary and one from eye across cheeks; fins dusky, the dersal paler at base, with many round dark olive-brown spots; a black opercular spot: lower rays of pectorals often tinged with orange. Body comparatively elongate, highest at shoulders. Head long, in form intermediate between mystinus and flavidus: snout rather sharp. Mouth large, oblique, the maxillary not quite reaching posterior margin of orbit; its length a little less than half head; lower jaw protruding, its tip on a line with the descending profile; premaxillaries on the level of the lower margin of pupil. Eve large. Cranial ridges almost obsolete, all scaled over and without spines in the adult; preocular spines obsolete, the space forward of the eye not projecting; preopercular spines short, but sharp. Gill-rakers longer than in mystimus, very slender. Dorsal rather low, deeply emarginate, the highest spines 2\frac{1}{2} in head. a little lower than the soft rays; caudal slightly emarginate. Anal spines small, the second shorter but stouter than third, longer than eve: pectorals short and rather broad, not reaching as far as tips of ventrals, which scarcely reach vent. Scales moderate; accessory scales numerous; mandible, maxillary, preorbital, and snout closely scaled. Peritoneum white. Head 3; depth 22. D. XIII-16; A. III, 8; Lat. l. 53; scales 69-70; pectoral 44. L. 20 inches. Monterey to Sitka; most abundant northward. At San Francisco much less common than 8. mystinus.

(Schastes melanops Girard, Proc. Acad. Nat. Sci. Phila, viii, 135, 1854, and in U. S. Pac. R. R. Surv. Fish. 81; Ayres, Proc. Cal. Acad. Sci. 1862, 213, f. 66: Schastes melanops Günther, ii, 93: Schastosomus simulans Gill, Proc. Acad. Nat. Sci. Phila. 1864, 147.)

#### 1011. S. ciliatus (Tiles.) J. & G.

Blackish green, the sides rather pale, much mixed with darker; dark shades from eye backward; a black streak on maxillary; fins all dusky, the upper fins somewhat mottled; adult said to have the body and fins tinged with red. Body rather deep and compressed. Mouth smaller than in melanops, the maxillary reaching to below posterior margin of pupil; lower jaw somewhat projecting, but without prominent knob at the symphysis; cranial ridges all obsolete, covered by scales; no preocular spine or any bulge of the skull in that region; preorbital narrow, without spine; preopercular spines short and broad; opercular and suprascapular spines small; lower jaw fully scaled, roughish. Head well

covered with ctenoid scales. Dorsal fin low, not deeply emarginate, the membrane joining the thirteenth spine near its middle; soft dorsal low, higher than the spines, the longest spine as long as maxillary, a little less than half head; candal emarginate; anal low, its second spine stronger, but not longer than the third,  $\frac{2}{3}$  the height of the soft rays,  $2\frac{1}{2}$  in head; pectorals rather short, reaching beyond tips of ventrals to vent. Gill-rakers numerous, very long and slender, nearly as long as the eye. Peritoneum black. Head  $3\frac{1}{3}$ ; depth  $3\frac{1}{3}$ ; pectorals  $3\frac{2}{3}$ . D. XIII-15; A. III, 8; Lat. l. 66. Coast of Alaska; not noticed south of Kodiak.

(Epinephelus ciliatus Tiles, Mém. Ac. Sci. St. Petevsb., iv, 474, 1810; Perca variabilis Pallas, Zoogr. Rosso-Asiat, iii, 241, 1811; Schastes variabilis Cuv. & Val. iv, 347; Schastes variabilis Günther, ii, 99.)

# 1012. S. mystimus Jor. & Gilb.—Pêche Prêtre; Black Rock-fish.

Slaty black, becoming paler below the lateral line; sides more or less mottled; tip of lower jaw black; top of head with 3 indistinct cross-bars, extending on the cheeks; a dark bar on anterior edge of opercle; fins all plain dusky. Body oval-oblong, compressed, both outlines evenly curved. Head rather blunt, compressed; profile oblique, almost straight, becoming convex with age. Month smaller than in any of the preceding species, oblique, the lower jaw protruding: premaxillaries on the level of lower rim of orbit; maxillaries dilated behind, reaching posterior margin of pupil, thickly scaled behind, their length  $2\frac{1}{5}$  in head. Cranial ridges obsolete, except the preocular, which usually ends in a small spine; the region between and in front of the eyes bulging considerably; preopercle with rather strong spines, the two at the angle longest; opercular spines rather strong. Spinous dorsal very low, the longest spines 23 in head, lower than the soft rays, the fin rather deeply emarginate; second anal spine stronger than third, and a little shorter, 34 in head; pectoral fins long, about as long as head, their middle rays longest, reaching beyond the ventrals to about the tenth dorsal spine; caudal emarginate. Peritoneum black. Head 31; depth 23; pectorals 34. D. XIII-15; A. III, 9; Lat. 1, 66 (50-55 tubes). L. 14 inches. Puget Sound to San Diego; the most abundant species of the family about San Francisco; found in rather shallow water.

(Sebastichthys mystimus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 455; 1881, 56, 70.)

# 1013. S. entomelas Jor. & Gilb.

Dull olive-green; sides with obscure, round, rusty spots; belly, lips, and lower parts tinged with creamy; obscure light and dark shades

across cheeks; 2 or 3 very obscure dark vertical bars; fins all dusky. somewhat reddish tinged: lower half of pectoral reddish. Body oblong-elongate, the back little arched. Candal peduncle slender. Profile less steep than in ovalis, the snout blunter. Mouth small, the short maxillary extending to below middle of eye, its length 21 in head; lower jaw protruding, its tip entering the profile; preorbital very narrow, without spine. Eve large, less than interorbital space, 4 in head. Cranial ridges very low, mostly covered by the scales; preocular, supraocular, tympanic, and occipital spines usually present, the preocular larger than in any of the preceding species, the supraocular and tympanie sometimes obsolete; preopercular spines small, directed backwards; opercular spines small; jaws, preorbital, and shout with small scales. Gill-rakers numerous, long, and slender, their length about 3 diameter of eye. Dorsal spines very low and slender, the longest about 3 in head, the fin moderately emarginate; soft dorsal long and low, not much higher than the spines; caudal lunate; anal low, its second spine stronger than third, but not so high, 3\frac{1}{2} in head; pectorals moderate, reaching beyond ventrals, not to vent. Peritoneum jet black. Head D. XIII-15; A. III, 8; Lat. l. 65. L. 12 34: depth 34: pectoral 33. inches. Monterey Bay, in deep water; rare.

(Schastichthys entomelas Jordan & Gilbert, Proc. U. S. Nat. Mus. 18-0, 142.)

# 1014. S. ovalis Ayres.—Viuva.

Olivaceous, strongly tinged with creamy red, especially below; membrane of both dorsals covered with many small, round, black spots; similar spots usually on the body; upper fins greenish, lower yellowish, mostly dark-edged; caudal fin dark; young more green, with 2 or 3 large black blotches on upper part of sides, and without dark spots on fins. Body deep, almost oval, the back considerably elevated, the profile steep, the lower jaw considerably protruding. Mouth not large, the maxillary reaching to posterior edge of pupil, its length about 25 in head. Cranial ridges not much developed, except the preocular, which forms a large triangular protuberance, ending in a spine; preocular, supraocular, postocular, tympanic, and occipital spines present; preopercular spines long and slender, all projecting backward; opercular spines strong; preorbital narrow, with 2 bluntish spines. Gill-rakers very long and slender, the longest two-thirds the diameter of the eye. Eye large, slightly longer than snout. Dorsal fin very low, the notch between the spinous and soft parts very shallow, the height of the two parts about equal (2½ in head), the membrane joining the last spine at

.

about  $\frac{3}{4}$  its height; second anal spine longer and stronger than third, almost as high as the soft rays,  $2\frac{1}{3}$  in head; pectorals long, reaching beyond tips of ventrals; caudal emarginate; maxillary and mandible scaly. Peritoneum black. Head 3; depth  $2\frac{3}{4}$ . D. XIII-14; A. III, 8; pectoral  $3\frac{1}{5}$ ; height of dorsal 8; Lat. l. about 70. L. 14 inches. Coast of California, in deep water; rare.

(Ayres, Proc. Cal. Acad. Sci. 1852, 212, f. 65; Schastichthys oralis Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 143.)

# 1015. S. proriger Jor. & Gilb.

Bright light red, mottled above with dusky olive-green, the ground color forming distinct blotches under the third dorsal spine and under the first and last rays of the soft dersal; lateral line running in the middle of a very distinct continuous red stripe, precisely as in S. elongatus: head above with purplish cross-shades; opercle with a dusky blotch: two olive shades radiating from the eye; lips and tip of lower iaw blackish; iris red; caudal fin bright red, speekled with dark olive; spinons dorsal bright red, the posterior part of each membrane blackish: soft dorsal olive and red: lower fins bright light red, with shades Body elongate, somewhat compressed, a little less of olive vellow. slender than in S. elongatus, which this species much resembles in color Head rather small. Mouth small, much as in S. ovalis, the short, broad maxillary extending to beyond the middle of the eye, the premaxillary on the level of lower margin of pupil; maxillary 21 in head; lower jaw strongly projecting, with a conspicuous symphyseal Eye very large, longer than snout; preorbital narrow. Cranial ridges very low and weak; preocular, supraocular, tympanic, and occipital present; most of the ridges partly covered by seales; tympanic spine minute; occipital ridge not conspicuous, the spine depressed. Preopercular spines sharp, the second longest, the points of all directed backward; opereular spines moderate. Interorbital space broad, nearly as broad as the eye, somewhat regularly convex, the middle being elevated. Gill-rakers very long, slender, and numerous, the longest longer than the supraocular ridge, and about half the diameter of the eye. Scales rather small. Dorsal fin very low, as in S. oralis, not deeply emarginate, the highest spine little more than one-third length of head; soft dorsal low, half as high as long, the highest ray about equal to the longest spine; caudal fin moderately forked; anal fin low, its length nearly equal to the height of its longest ray; second spine much longer and stronger than the third, searcely shorter than the longest ray,  $2\frac{1}{3}$ 

in head; pectorals rather long and narrow, the tips reaching beyond the tips of the ventrals to the vent. Peritoneum black. Head 3; depth 3!. D. XIII-13; A. III, 7; pectoral 3½ in length; Lat. l. 75. L. 10 inches. Coast of California, in deep water; not rare.

(Sebastichthys proriger Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 327.)

aaa. Species with the scales moderate, the cranial ridges low, the skull thick, the interorbital space broad and convex, the lower jaw scaly, its tip not strongly projecting; gill-rakers slender; pectorals narrow; peritoneum white.

#### 1016. S. atrovirens Jor. & Gilb.—Garrupa.

Olive-green, marbled with darker; sometimes brownish; belly pale vellowish green; fins olivaceous, no red anywhere. Body oblong, not tapering rapidly backward. Head moderate, rather pointed. Mouth moderate, the lower jaw somewhat projecting, the maxillary extending to beyond posterior border of the pupil; its length 2 in head; premaxillary below pupil. Eye large, 34 in head Cranial ridges low, not ending in prominent spines; the following pairs are present: preocular, supraocular, and occipital, and sometimes a minute tympanic; nasal spines prominent; preorbital very narrow, with two stout spines; preopercular spines short, rather sharp, the second longer and slenderer than the others; opercular and suprascapular spines sharp; interorbital space broad and slightly convex, widened backward, a little depressed on each side next the supraocular spine, its width less than that of the eye and more than the length of the occipital spine. Gillrakers slender, not very long, the longest \{\frac{1}{2}} the diameter of the eye. Preorbital scaly; maxillary partly scaly; mandible with some smooth scales; scales large, regularly arranged. Dorsal fin rather deeply emarginate, the spines moderate, the fifth half length of head and lower than the soft rays; candal truncate; anal fin short and high, its spines slender, the second shorter than third, and not much stronger, about 23 in head; longest soft rays 13 in head; pectorals long and narrow, reaching past vent nearly to beginning of anal, their length seveneighths that of head, their base narrow. Ventrals long, reaching just Head 3; depth 24. D. XIII-14; A. III, 6; Lat. l. 52. past the vent. L. 15 inches. Coast of California; generally abundant, especially southward.

(Sebastichthys atrovirens Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 289.)

## 1017. S. pinmiger (Gill) J. & G.-Fliaum: Orange Rock-fish.

Ground color light olive-gray, profusely blotched with bright clear orange-red or with light orange-yellow, the red shades predominating

above, the pale below; belly nearly white; top of head with crossblotches and marblings of orange, alternating with pale; sides of the head flesh-colored, with three bright orange bands radiating from the eve: maxillary with orange touches; lips pale, tinged with blackish; inside of mouth pale; dorsal fin with the membrane bright orange, a large black blotch occupying the membranes between the seventh and tenth dorsal spines; this spot is usually distinct, but in old examples it is sometimes obsolete; pectorals light red, mottled with yellowish; other fins all bright orange, without dusky tips, slightly mottled with paler at base; lateral line running in a distinct continuous light-gray streak, which is not crossed by the red markings; old specimens sometimes with large inky blotches on different parts of the body. rather robust, elevated, and compressed. Mouth large, oblique, the maxillary reaching to below the posterior margin of the large eye, its length half the head; mandible somewhat projecting, with a knob at the tip: the middle teeth on a raised base which fits into the emargination of the upper jaw; interorbital space very broad, concave on either side of the convex center, as wide as the eye, which is 4 in head, cranial ridges low, but stronger than in preceding species; preocular, supraocular, postocular, tympanic, and occipital present; the space between the two occipitals concave: the ridges small but sharp; both jaws, preorbital, maxillary, mandible, and snout scaly, the scales on the lower jaw smooth; preorbital rather narrow, with two spines; preoperenlar spines long and sharp. Dorsal fin deeply emarginate, the spines rather high, nearly as high as the soft rays, the longest 21 in head; candal fin lunate; pectoral fin long, reaching to the tips of the long ventrals, past the vent; base of pectoral narrow, about as broad as eye; second anal spine strong, nearly as long as third, 3 in head. Gill-rakers very long and slender, nearly \( \frac{2}{3} \) diameter of eye; accessory scales numerous, especially on head. Peritoneum pale. depth 2\frac{3}{5}; pectoral 3\frac{1}{5}. D. XIII-14; A. III, 7; Lat. I. 48. L. 25 inches. Pacific coast, from Monterey northward; one of the most important species.

(Schastodes rosacens Ayres, Proc. Cal. Acad. Sci. ii, 216, 1862, f. 62; not Schastes rosacens Grd.; Schastosomus pinniger Gill, Proc. Acad. Nat. Sci. Phila. 1864, 147; Schastichthys pinniger Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 72.)

#### 1018. S. mimiatus Jor. & Gilb.—Rasciera; Rasher,

Color above deep vermillion, mottled with flesh-color on the sides, the belly light red; back and sides everywhere with clusters of black dots,

so that the whole body has a dusky shade; top of head and back with vaguely defined cross-blotches made of dark points; three obscure orange stripes radiating from the eye: maxillary with a red streak; lips red, mottled with blackish; under side of head light red, mottled with darker; inside of mouth red; fins all bright vermillion; spinous dorsal spotted with olive-gray below, the membrane posteriorly edged with blackish: soft dorsal spotted below with blackish, a vertical dark olive streak on each membrane; other firs tipped with blackish, the membranes more or less dotted; no black blotch on the spinous dorsal. Body oblong, the form much as in S. vinniger. Head moderate, somewhat Mouth rather large, the maxillary reaching past pupil, its length 2 in head; premaxillary on level of lower edge of pupil; lower jaw projecting somewhat beyond upper, with a moderate symphyseal knob; middle of lower jaw elevated, fitting into an emargination of the upper. Head more completely scaly than in related species, the scales also rougher, the scales on the preorbital and head generally, being fully ctenoid; mandible scaled even to the symphyseal knob, its scales always roughly etenoid; interoperele fully scaled; most of the branchiostegals with series of scales; maxillary, preorbital, and tip of snout fully scaled; preorbital with a narrow neck; cranial ridges low and small; preocular, supraocular, postocular, tympanic, and occipital spines present; interorbital space very broad, with a slight depression on each side of a median ridge: preopercular spines rather long and sharp, the second the longest, the spines radiating. Gill-rakers, as in pinniger, very long and slender, the longest about 2 the diameter of the eye. Dorsal fin low, rather deeply emarginate, about as in S. pinniger, but rather higher, the soft rays higher than the spines; eaudal fin slightly emarginate; anal fin rather high, the second spine about as long as the third and stouter, little more than half the height of the soft rays, about 3 in head; pectoral fin moderate, the tip reaching about to the vent, the base rather narrow; ventrals very long, usually reaching past the vent, almost to the beginning of the anal. Head  $2\frac{3}{4}$ ; depth 3; pec-Dorsal rays XIII-14; A. III, 7; Lat. l. 47. L. 20 inches. San Francisco to San Diego; not rare.

(Selastichthys miniatus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 70.)

aaaa. Species with the scales of moderate size; the eranial ridges high; tympanic and postocular spines both present; lower jaw little projecting; anal rays III, 7; scales on head ctenoid; gill-rakers short; second anal spine usually elongate. (Sebastomus\* Gill.)

<sup>\*</sup>Gill, Proc. U. S. Nat. Mus. 1864, 147: type Sebastes rosaceus Grd.

# 1019. S. ruber (Ayres) J. & G.—Red Rock-fish; Tambor.

Color clear deep vermilion red, paler below; a narrow undulating whitish streak along the sides, from the eye to above the base of the anal, and another along the lateral line; these indistinct in the adult: faint dusky shades radiating from eye; fins red, the soft fins always largely blackish at tip, especially in the young; young more distinctly marked than the adults, which are nearly plain brick-red. Body oblong, rather deep, not much compressed. Head large, blunt. Mouth large, the maxillary reaching nearly to posterior edge of eye, its length half that of head; premaxillary on level of lower edge of pupil; lower jaw a little projecting, the symphyseal knob slight. Cranial ridges rather high and sharp, smooth in the young, becoming very rough and broken in the adult; preocular, supraocular, postocular, tympanic, and occipital present; preocular spines triangular; supraocular short, becoming with age divided into a series of irregular spines and tubercles; occipital ridges diverging, likewise divided in adults: interorbital space broad, flattish. coarsely scaled, with 2 slight ridges anteriorly. Eve moderate, 41 in head: preorbital wide; preopercular spines broad, usually divided, the Scales on head rough; jaws naked; suborbital stay weak. Gill-rakers short, clavate, the longest \(\frac{1}{4}\) eye. Scales on body rough; accessory scales numerous; pectoral short, broad, its length 4 in body; dorsal spines stout, rather low, the fin not deeply notched, the longest spine about as high as the soft rays, 24 in head; caudal truncate; soft fins scaly; second anal spine little stronger or longer than the third, 2 height of soft rays, 23 in head. Peritoneum white. Head 3; depth 23. D. XIII-14; A. III, 7; Lat. l. about 50. L. 30 inches. Pacific coast, from Santa Barbara northward, abundant; reaches a larger size than any of the others, except possibly S. paucispinis.

(Sebastes ruber Ayres, Proc. Cal. Acad. Sci. i, 7, 1854, and 1862, 215.)

## 1020. S. constellatus Jor. & Gilb.

Orange-red; back olive shaded; belly yellowish; cheeks with red and yellowish shades; head and body everywhere closely covered with small roundish pale spots; spots above light rose color; below larger and nearly white; 4 or 5 roundish rose-colored blotches on the back, besides some mottlings of a similar shade; the first spot, often obscure, under the fourth dorsal spine; the next near the lateral line under the eighth dorsal spine; the third close to the junction of the two parts of the dorsal; the fourth under the end of the soft dorsal; a fifth sometimes near the base of eighth dorsal spine; opercular flap with a rosy

spot; fins light reddish; dorsal speckled at base with light and dark. Body robast, heavy forwards, tapering into a slender caudal peduncle. Head rather pointed in profile. Mouth large, oblique, the lower jaw slightly projecting beyond the emarginated tip of the upper jaw; a small knob at the symphysis; maxillary very broad, extending beyond pupil, its middle part with many small scales, its length 2 in head: premaxillary in front just below the level of the eye: mandible almost entirely covered with small rough scales; muzzle and precapital scaled to the tip of the snout; head densely covered with small scales. Cranial ridges rather high and narrow; preocular, supraocular, postocular, tympanic, and occipital present; interorbital area concave, with 2 prominent ridges covered by scales; supraccular ridge rather. short; occipital ridge long, curved, ending in a sharp spine; preopercle with its second spine long and sharp; preorbital wide, its edge lobed. Eve large, 4 in head. Gill-rakers short, clayate, the longest of them about one-fifth the diameter of the eye. Scales strongly etenoid, the accessory scales largely developed. Dorsal spines rather strong and low, the fourth more than one-third the length of the head; the fin rather deeply emarginate; soft dorsal rather low, about as high as the second anal spine,  $2\frac{3}{4}$  in head, robust, curved considerably longer than the third or the soft rays; caudal slightly emarginate; pectorals rather narrow, reaching beyond ventrals, about to vent, their length twothirds that of the head. Peritoneum white. Head 24; depth 24. D. XIII-13; A. III, 6; Lat. l. 53. L. 15 inches. Coast of California, from San Francisco southward, abundant in deep water; a brilliantly-colored fish.

(Sebastichthys constellatus Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 295.)

#### 1021. S. rosaceus (Grd.) J. & G.-Corsair.

Bright orange red, the young strongly tinged or mottled with golden yellow; back with 4 pale spots, arranged precisely as in 8. constellatus, rhodochloris, and chlorostictus: these always very distinct, of a rose-pink color, or sometimes almost white; the darker border around them is of a deep purple or blood color, never greenish; fins rosy, mottled with orange; head with radiating stripes of orange and rosy; nape with alternating bars of yellowish and deep red, the colors blending; no decided green, and no small pink spots anywhere. Body oblong, little elevated. Head rather pointed. Mouth moderate, the jaws about equal, the lower with a small knob; maxillary not reaching posterior border of eye; its length 2 in head; premaxillaries below the orbit.

Eye very large,  $3\frac{1}{2}$  in head. Maxillary and preorbital partly scaled; mandible and snout naked. Cranial ridges much as in 8. constellatus, but more depressed; preocular, supraocular, postocular, tympanic, and occipital present; length of supraocular spine about equal to interorbital width; preopercular spines short. Gill-rakers moderate, longer than in 8. constellatus, not clavate. Scales moderate, the accessory ones numerous. Dorsal spines rather low and strong, the fourth two fifths the length of the head, about as high as the soft rays, the fin rather deeply emarginate; candal slightly notched; anal rather low, with the second spine curved,  $2\frac{1}{3}$  in head, much longer and stronger than third, shorter than the soft rays; pectoral fins moderate, reaching beyond tips of ventrals, past the vent,  $3\frac{1}{3}$  in body. Peritoneum blackish. Head  $2\frac{3}{3}$ ; depth 3. D. XHI-13; A. HI, 6; Lat. l. 48. L. 12 inches. Coast of California, in rather deep water; the most abundant of the red species, and one of the smallest.

(Sebastes rosaceus Grd. Proc. Acad. Nat. Sci. Phila, viii, 146, 1854, and in U. S. Pac. R. R. Surv. Fish, 78, pl. 21 (poor figure, from a specimen in bad condition): Schastes belromaculatus Ayres, Proc. Cal. Acad. Sci. ii, 26, f. 8, 1859; Schastes rosaceus Günther, ii, 98.)

# 1922 S. rhodochloris Jor. & Gilb.—Fly-fish.

Bright clear rose-red, without trace of purplish; region above lateral line with much deep green in the form of reticulating streaks; below the lateral line the green gives place to bright golden yellow similarly mixed with red; top of head with cross-bands of green and red; green streaks radiating from the eye; four bright pale pink spots on the sides of the back, arranged precisely as in rosaccus, constellatus, and chlorostictus, the color brighter than in these, surrounded by rings of green, without any trace of purplish shading; a pink opercular spot; a pale area behind eye; fins all with the rays red, the membranes olive or Body oblong, more elongate than in related species; maxillary 2½ in head, reaching beyond pupil; jaws about equal; preorbital Eyes very large, 31 in head. Cranial ridges higher and sharper than in any other of the red species; preocular, supraocular, postocular, tympanie, and occipital species present; interocular space very narrow, its width less than length of supraocular spine; two sharp ridges extending lengthwise of it; preopercular spines long. Gill-rakers as in rosaccus; mandible finely scaled near the base. Dorsal fin moderately emarginate, lower than in rosaccus, the longest spine nearly 3 in head; soft dorsal as high as spines; candal slightly notched; second anal spine longer than in any other species, longer than maxillary, higher than the soft rays, half length of head; pectoral reaching past ventrals, nearly to anal,  $3\frac{2}{3}$  in body. Peritoneum dusky. Head  $2\frac{1}{2}$ ; depth 3. D. XIII-14; A. III, 6; Lat. l. 58, the accessory scales very numerous. L. 12 inches. Off Montercy and San Francisco, in deep water; rather rare.

(Sebastichthus rhodochloris Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 144.)

# 1023. S. chlorostictus Jor. & Gilb.—Pesca Vermiglia.

Olivaceous above, sides pinkish and golden: four roundish spots of pink placed as in S. constellatus and S. rosaceus, but less distinct; a pink blotch on opercular flap; the upper parts of the body, from just below the lateral line, closely covered with small round spots of a clear olive-green; these spots most distinct on the back and the top of the head; on the sides of the body, just above and below the lateral line. these spots form two continuous series, following the course of the lateral line; eyes above with green spots; fins nearly plain red; base of dorsal spotted with olive. Body oblong. Head moderate, the profile rather steep, with a nearly even slope. Mouth large, oblique, the maxillary reaching to behind the pupil, its length about  $2\frac{1}{5}$  in head; the premaxillary in front below the level of the large eye, which is 31 in Jaws equal in the closed mouth, the tip of the lower fitting into the emarginate upper jaw; a rather conspicuous symphyseal knob. Preorbital sinuate. Cranial ridges sharp and high, ending in sharp spines, about as in constellatus; preocular, supraocular, postocular, tympanic, and occipital present. Inteorbital space concave, with two rather prominent ridges. Preopercular spines rather sharp, the second longest; opercular spines sharp. Gill-rakers long and rather strong, not clavate, the longest about two-fifths the diameter of the eye, longer than in related species. Scales on head fewer than in S. constellatus; the snout wholly naked; maxillary partly sealed; mandible naked. Dorsal spines very high, nearly as high as in vexillaris; the fourth highest, nearly half head, higher than the soft rays, which are also considerably elevated. Dorsal fin rather deeply emarginate; caudal fin emarginate; anal fin not very high, its second spine much higher and stronger than the third, about as high as the soft rays, 21 in head; pectorals 3\frac{1}{3} in length, with moderate base, reaching beyond tips of ventrals, about to vent. Head 21; depth 23. D. XIII-13; A. HI, 6; Lat. l. 50. L. 15 inches. Off Monterey and San Francisco; abundant in deep water.

aaaaa. Species with the lower jaw projecting and scaly; the postocular spine wanting; the body elongate; the peritoneum dusky; otherwise as in the preceding group.

#### 1024. S. clongatus (Ayres) J. & G.—Reina.

Color light red: sides above with irregular horizontal interrupted olive-green bands, which are more or less broken into blotches, two of these bands below the lateral line, becoming confluent behind; a distinct pale band following the course of the lateral line: upper fins blotched with olive, lower pale red; head olive and blotched above. pale red below; chin black. Body more elongate than in any of the other species (except paucispinis), compressed. Head long, rather pointed. Mouth large; maxillary extending to posterior margin of pupil, its length 24 in head; premaxillary on level of lower margin of orbit: lower jaw strongly projecting. Eve very large, longer than suont, 31 in head; interorbital space broad, concave, with low frontal ridges. Cranial ridges low and long; preocular, supraocular, tympanic. and occipital present; tympanic spines small; preopercular spines very sharp, all pointed, directed backwards; opercular spines very long and sharp. Gill-rakers long and strong, the longest about one-third the eve. Scales large, not very rough; accessory scales numerous. Maxillary, mandible, and preorbital scaly. Dorsal spines moderately high, rather strong, the highest about equal to the soft rays, 23 in head; the fin not deeply emarginate. Caudal fin lunate; anal fin rather low; the second spine half length of head, much longer than the third, higher than the soft rays; pectorals moderately broad, long, reaching beyond the tips of the short ventrals to vent. Peritoneum dusky. Head  $2\frac{3}{5}$ ; depth  $3\frac{1}{5}$ ; pectoral 3½. D. XIII-13; A. III, 6; Lat. l. 58. L. 12 inches. About Monterey and San Francisco; abundant in deep water. This species bears considerable resemblance to S. proriger.

(Sebastes elongatus Ayres, Proc. Cal. Acad. Sci. ii, 23, 1859, f. 9.)

auaaaa. Species with the scales of moderate size; the cranial ridges well developed; the postocular wanting; scales smoothish; those on the head mostly cycloid; lower jaw naked, its tip protruding; peritoneum white; second anal spine long.

#### 1025. S. rubrivinctus Jor. & Gilb.—Spanish Flag.

Very pale rose-red, almost white, with cross-bands of a deep, intense crimson-red; these bands broadest on the back; one of the bands runs across the eye, snout, suborbital and maxillary, its boundaries indistinct; the next across the nuchal region, front of dorsal and opercle: the next across the middle of the spinous dorsal, including the ventrals and the postrior half of pectorals; another across soft dorsal and anal; another across base of caudal, the fin itself being deep rose color; the other fins share the color of that part of the body against which they

Body robust, rather deep and compressed. Head long, acute in profile, there being a nearly straight slope from a bony prominence in front of the spinous dorsal to the tip of the lower jaw. Month rather large, oblique, the lower jaw projecting: maxillary broad, extending to opposite the middle of the eye; its length 21 in head; premaxillary on level of lower border of eye; cranial ridges quite low, their spines bluntish and depressed: preocular, supraocular, tympanic, and occipital ridges present; interorbital space flattish, narrow, not so broad as the eye, not widened behind, with sparse, smooth scales; two long frontal ridges extend the length of the interorbital space; these are covered with bare skin; behind and between these are two shorter ridges covered by naked skin; occipital ridges long, curved, diverging behind: mandible naked; maxillary with a few scales; suborbital stay very prominent, its tip nearly reaching the preopercle; preopercular spines very strong, the second longest; opercular spines long; preorbital wide. Eye very large, its diameter 33 in length of head. Gill-rakers rather short, robust, much compressed, the longest about one-fourth the length of the eye. Scales on head all small and thin, mostly cycloid: scales of body smoother than usual; accessory scales very numerous. Dorsal spines robust, rather high, the fifth not quite half the length of the head; those behind rapidly shortened, the membrane joining the thirteenth spine below its middle; soft rays about as high as spines: caudal slightly emarginate; anal low, its second spine 2½ in head, much longer and stronger than third, both robust; pectorals moderate, not reaching vent, 32 in length; the base equal to diameter of eye; ventrals not reaching tips of pectorals. Peritoneum white. depth 21. D. XIII-12; A. III, 7; Lat. l. 55. L. 15 inches. Barbara to Monterey, in deep water; rare. In life, the most brilliantly colored large fish in our waters.

(Sebastichthys rubrivinctus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 291.)

aaaaaaa. Species with the scales of moderate size, the cranial ridges strong and mostly high, but not sharp, the postocular wanting; the jaws nearly equal, the lower naked; the gill-rakers short; the pectorals broad, with thickened lower rays; anal HI, 5 to HI, 7. (Schastichthys\* Gill.)

## 1026. S. améculatus (Grd.) J. & G.

Color blackish brown, much mottled with light brown; top of head dark; a dark blotch on the upper angle of the opercle; entire body flushed with brownish red, this color most noticeable on front of head;

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1892, 278: type Schustes nigrocinetus Ayres:  $(\delta \epsilon \beta \alpha \delta \tau \delta \epsilon$ , magnificent;  $i \chi \hbar \dot{\nu} \epsilon$ , fish.)

a brownish red streak along middle of maxillary, and a second from the preorbital downwards and backwards across the check; another from eve to lower part of opercle; fins all marked with dark and light olive and reddish, the latter hue especially on the ventrals and anal; base of pectoral blackish; northern specimens are more blackish, and less uniform in color; old specimens are often nearly uniform reddish brown; the young sometimes with obscure dark bars, the candal fin speckled. Body oblong: rather deep. Mouth moderate, below axis of body, the jaws nearly equal; maxillary reaching beyond eye, its length 23 in head; preorbital broad; interorbital space concave on each side of a broad median ridge; preocular, supraocular, tympanic, coronal, and occipital spines present, the latter sometimes divided; preopercular spines long, all directed backward, the second longest; opercular spines weak: 3 suprascapular spines. Scales on body large, etenoid: accessory scales not very numerous; mandible naked. Spinous dorsal high, the longest spine 2 in head, higher than the soft rays, which are much elevated; second anal spine longer and stronger than third, 21 in head; soft part of anal high; pectorals rather short and broad, the tips barely reaching the vent, their length 35 in body; ventrals reaching to vent; candal truncate. Head  $3\frac{1}{5}$ ; depth  $2\frac{1}{2}$ . D. XIII, 13; A. III, 7; Lat. l. 45. L. 18 inches. Pacific coast, from Vanconver's Island to Cerros Island, very abundant; the only species entering the bays and caught with hook and line from the wharves. It may be known at once by the coronal spines, which are developed on no other American species of the genus. In some of our specimens from the Gulf of Georgia these spines are obsolete on one or both sides.

(Sebastes aurientatus Grd. Proc. Acad. Nat. Sci. Phila, 1854, 131, 146, and U. S. Pac. R. R. Surv. Fish. S0: Sebastes aurientatus Ayres, Proc. Cal. Acad. Sci. 1862, 215, f. 68: Sebastes ruber var. parens Ayres, Proc. Cal. Acad. Sci. i, 7, 1854.)

#### 1027. S. rastrelliger Jor. & Gilb.—Grass Rock-fish.

Blackish green, with paler mottlings, the sides spotted with darker; belly pale greenish; paired fins dark, often bordered with reddish; other fins chiefly olivaceous, spotted with darker; the brightness of the olive and greenish shades is quite variable, but the species is always without definite markings and without bright red. Body oblong, deepest at the shoulders. Head short, blunt. Mouth moderate, little oblique, the maxillary reaching to the posterior margin of the eye, its length  $2\frac{1}{5}$  in head; the premaxillary rather below the level of the eye; jaws equal, without symphyseal knob. Eye small, anterior,  $4\frac{1}{5}$  in head. Cranial ridges

strong, but broad and depressed, ending in small spines: preocalar, supraceular, tympanic and occipital present; the occipital ridges are very long, equalling the diameter of the orbit; preopercular spines short and stout, the two upper subequal: opercular spines very broad and flat, sometimes bifid: suprascapular spines strong: interorbital space moderate, narrower than eye, flattish, with two low ridges; spines of head little divergent backwards. Gill-rakers very short, wide, compressed, the longest almost as wide as high. Scales on body large: accessory scales few. Dorsal spines low, the fifth about two-fifths the length of the head: the fin little emarginate: soft rays considerably higher than spines; caudal slightly rounded; anal high, its spines low, the second as high as the third and much stouter, 3 in head; pectoral rather short, reaching vent, its base extremely broad, its width about one-third length of head; the lower rays much thickened; length of pectorals 33 in body; ventrals moderate, not quite reaching the tips of the pectorals. Peritoneum brownish. Head 3; depth 2\frac{3}{2}. D. XIII-13; A. III, 6; Lat. l. 47. L. 15 inches. Coast of California; abundant southward. A strongly marked species, known at once by its short gill-rakers.

(Sebastiehthys rastrelliger Jor. & Gilb. Proc. U. S. Nat. Mus, 1880, 296.)

#### 1028. S. caurinus (Rich.) Jor. & Gilb.

This form agrees with the subspecies rexillaris, in general characters, differing in the color, which is scarcely reddish or yellowish, the dark shades being dark brown, the pale shades light brownish and better defined than in rexillaris; the chin is rather more projecting; the dorsal spines are slender and much lower than in rexillaris; in this respect there is considerable variation among individuals; the armature of the head is essentially the same as in rexillaris, as are the fin-rays, gill-rakers, and scales. Puget Sound to Sitka; abundant.

(Sebastes canrinus Richardson, Voy. Sulphur. Ichth. 77, pl. 41, f. 1, 1845. This species has no special affinity with the Japanese S. inermis, with which it has been identified by Dr. Günther.)

#### Sabsp. vexillaris Jor. & Gilb.—Garrupa.

Bright pale yellowish-red, becoming lighter below, the reddish and yellowish forming large and irregular areas, sometimes one shade predominating, sometimes the other; a pink cross-blotch on the back at base of the second and third dorsal spines sometimes present; upper parts of head mostly pink, with broad olive shades running backward, one on the lower lip, one on the maxillary, one from preorbital region downward, one from the eye backward and downward across the cheeks,

and another across the opercular spines: fins all pinkish red, the membranes olive; vertical fins narrowly edged with dusky; top of head usually with alternating cross-shades of pinkish and vellowish; vellowish shades sometimes replaced by light olive; other specimens are quite red; still others brownish; the light areas on the back have a position similar to that of the rosy spots in S. constellatus. Body stout and compressed, the back elevated. Mouth rather large, the broad maxillary extending behind the orbit, its length 2 in head; premaxillary on level of lower edge of pupil; jaws subequal, the lower somewhat projecting, but without symphyseal knob; the upper jaw emarginate at tip. Cranial ridges long and low, higher than in rastrelliger, the preocular, supraocular, occipital, and sometimes tympanic present; preocular spines conspicuous, extending well backward; occipital spines rather long, diverging backward; interorbital space broad and flattish, narrower than eye. occupied by two raised ridges, covered by the scales; preopercular spines moderate, some of them usually divided into two, three, or four at tip, the middle one the largest. Eye moderate, high up, 4-43 in head: preorbital very broad; suborbital stay short. Jaws naked. Gill-rakers rather long and strong, the longest slightly clavate, nearly half as long as eye. Dorsal spines very strong and high, about as in chlorostictus, nearly as high as in maliger, the highest more than half length of head, and rather higher than the very high soft rays; membrane of spinous dorsal rather deeply incised, but less so than in maliger; second anal spine 3 in head, scarcely longer than the third, and not much stronger, about two-thirds as high as the soft rays; caudal truncate; pectoral shorter than head, not reaching the vent; its base rather broad, its length  $3_4^3$  in body; ventrals not reaching vent. Peritoneum white. D. XIII-16; A. III, 6; Lat. l. 55. L. 18 inches. Coast of California, abundant southward; apparently a geographical variety of S. caurinus, but quite different in color.

(Sebastichthys resillaris Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 292.)

#### 1029. S. maliger Jor. & Gilb.

Color warm yellowish brown, the anterior portion of the back and sides usually clear yellow; breast yellow; anterior part of body and head, especially in the adult, closely covered with small round spots of a clear orange-brown color; posterior part of body darker than anterior, variously mottled; soft fins all slaty black, the pectorals and dorsal paler at base and speckled; brownish shades radiating from the eyes. Body oblong, robust. Head large. Mouth moderate, the jaws nearly

Bull. Nat. Mus. No. 16——43

equal when closed; maxillary reaching to opposite posterior margin of eye, its length about half that of head; preorbital moderate, with an angular lobe. Cranial ridges a little higher than in caurinus, a little lower than in carnatus; preocular, supraocular, tympanic, and occipital present; occipital ridges low; preopercular spines very short; opercular long. Gill-rakers moderate, somewhat clavate, about as long as Scales rough. Jaws naked. Dorsal spines very high and strong, higher than in any other species, the membranes very deeply incised, so that half or more of the length of the highest spines is free anteriorly; highest spine about \( \frac{5}{8} \) length of head, the fin deeply emarginate; soft dorsal high, but lower than the spines; caudal truncate; anal high, the second spine  $2\frac{1}{3}$  in head, little higher than the third, not two-thirds the height of the soft rays; pectorals very broad and rounded. reaching beyond ventrals to vent; base of the fin broader than eve, the lower rays thickened; its length 31 in body. Peritoneum pale. 23; depth 21. D. XIII-13; A. III, 6; Lat. l. 47. L. 20 inches. Monterey to Sitka, mostly in deep water, very abundant northward; one of the largest species.

(Sebastichthys maliger Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 322.)

#### 1039. S. carmatus Jor. & Gilb.

Yellowish brown, with blotches of clear flesh-color or pinkish, the dark color predominating above, the pinkish below; membrane between third and fourth spines always pale, this color forming a blotch at the base of these spines, and then extending obliquely downwards and backwards, usually joining the ventral color; in front of this light area on the sides is a narrow oblique dark one, in front of which in turn is a pale one, which begins at the angle of the operele and divides, passing around the pectorals and uniting below them; a light blotch under the eighth dorsal spine, extending up on the fin; another at junction of the two dorsals, and another under the last ray; under each of these are irregular undulating pale areas; sides with pale blotches of all sizes; head above with cross-shades and bands radiating from eye, its light shades tinged with purplish; fins colored like neighboring parts Body rather short and deep. Month low and rather short, the maxillary extending to rather behind the posterior edge of the eye, its length 2 in head; premaxillary entirely below eye; jaws about equal; no symphyseal knob. Scales on head rather rougher than in S. chrysomelas; lower jaw, maxillary, space in front of eye and nasal region Cranial ridges well developed, but somewhat lower than in S.

chrysemelas covered with thick skin; preocular, supraocular, tympanie, and occipital present; occipital spines lower and narrower than in chrysomelas; preopercular spines small and bluntish. Gill-rakers short, clavate. Spinous dorsal always higher than in chrysomelas, the highest spines 2 in head, rather higher than the soft rays, the membranes more deeply incised than in chrysomelas; caudal truncate; anal moderately high, the second spine,  $2\frac{3}{4}$  in head, stronger and slightly longer than third, about two-thirds height of soft rays; pectorals rather short,  $3\frac{1}{2}$  in head, about reaching to the vent, their bases very broad, the lower rays thickened and fleshy; ventrals reaching vent. Peritoneum white. Head  $2\frac{2}{3}$ ; depth  $2\frac{3}{3}$ . D. XIII-13; A. III, 6; pyloric cœca 8; vertebræ 12 + 15; Lat. I. 43. L. 14 inches. Coast of California, generally abundant; in rather shallow water.

(Sebastichthys carnatus Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 73.)

# 1031. S. chrysomelas Jor. & Gilb.

Pattern of coloration precisely as in S. carnatus, the colors different; light shade a clear, warm, brownish yellow, with some specks of deeper orange; varying from a dusky orange to olivaceous yellow, the latter color more often seen on the belly; dark shade, black or dark brown, with slight olive tinge; dark color predominating on the back; membrane between third and fourth dorsal spines and an area at the base of these spines always pale; a yellow blotch extending thence downward and backward, usually joining the light color of the belly; another light area passing from near the angle of the opercle around the pectorals. uniting below them; three other blotches along the back, one under the eighth dorsal spine, one under the last spine, and one under the last soft ray; from each of these, irregular pale areas extend down the sides; fins the color of the region to which they belong; head above with dusky cross-shades and faint bands radiating from the eye. Body short and stout, compressed. Head short, bluntish. small, entirely below the axis of the body; lower jaw slightly included; premaxillaries on level of lower edge of orbit; maxillary reaching posterior margin of eye, its length 2 in head; preorbital wide. Cranial ridges very prominent, high and strong, covered with thick skin, ending in strong spines, which diverge backward; preocular, supraocular, tympanic, and occipital present; preopercular spines short and thick. Gillrakers as in S. carnatus. Scales moderate, rough, the accessory ones few; lower jaw, maxillary, nasal region, and space in front of eye naked. Dorsal spines high and strong, the highest 24 in head, rather higher than the soft rays, the fin deeply emarginate; second anal spine 23 in

head, much stronger than third, the two about equal in length; pectoral  $3\frac{3}{4}$  in head, with very broad base, reaching beyond the tips of the ventrals, which reach nearly to the vent; lower pectoral rays thickened; candal truncate. Peritoneum pale. Head  $2\frac{3}{4}$ ; depth  $2\frac{3}{4}$ . D. XIII, 13; A. III, 6. Lat. l. 45. L.13 inches. San Francisco to San Diego, abundant in rather deep water.

(Schästichthys chrysomelas Jor & Gilb. Proc. U. S. Nat. Mus. 1880, 455, 465.)

# 1032. S. mebulosus (Ayres) Jor. & Gilb.—Garrupa.

Ground color blue-black of varying shade, sometimes tinged with yellowish anteriorly, everywhere finely and irregularly freekled and spotted with yellow or white, the light color usually bright and sharply defined; these spots smallest and most numerous on head; a broad irregular yellow band, made of confluent blotches, from between the third and fourth dorsal spines, involving their membranes, downward to the lateral line, thence backward to base of caudal; fins all black, with light spots at base; under parts soiled yellow. Body robust, the back elevated, the profile steep. Mouth rather large, the jaws equal, the maxillary 2 in length of head, extending to beyond pupil; jaws naked. Eye large. Cranial ridges high and thick, comparatively short; preocular, supraocular, tympanic, and occipital present, the latter much higher than in chrysomelas, and bulging so that its base is narrower than its upper part; interorbital space narrow; preopercular spines short. Gill-rakers as in chrusomelas. Dorsal rather high, considerably emarginate, the highest spines, 2 in head, higher than the soft rays; candal truncate; second anal spine 23 in head, stouter and slightly longer than third, much lower than the soft rays; pectorals short and broad, 35 in length, reaching beyond tips of ventrals to vent. Scales rough, the accessory scales numerons. Peritoneum pale. Head 3; depth 23. D. XIII-13; A. III, 7; Lat. 1. 49. inches. Pacific coast, from Vancouver's Island to Monterey, in rather deep water; abundant.

(Sebastes fasciatus Grd. Proc. Acad. Nat. Sci. Phila. 1854, 146, and in U. S. Pac. R. R. Surv. Fish. 79, not of Storer: Sebastes nebulosus Ayres, Proc. Cal. Acad. Sci. i, 5, 1854; Sebastichihys fasciolaris Lockington, Proc. U. S. Nat. Mus. 1880, 297)

## 1033. S. serriceps Jordan & Gilbert.—Tree-fish.

Dark ofive, blackish above, yellowish below; sides with about 7 oblique black cross-bands, wider than eye, usually sharply defined, but sometimes faint in the young; two black bands downward and backward from eye; lips, mouth, front and lower part of head strongly washed with coppery red; bases of fins with small whitish spots; fins

blackish olive: cranial ridges black. Body robust, compressed behind. Head compressed. Mouth large, the maxillary reaching to opposite middle of eye, its length 23 in head; jaws equal. Cranial ridges thick. short, high and strong, covered with lax, thick skin, placed nearly in a right line on each side; preocular, supraocular, tympanic, occipital, and nuchal spines usually present, the latter sometimes coalescent with the occipital; interorbital space narrow, flat, closely scaled; preorbital rather broad; preopercular spines sharp; jaws naked; membranes of spinous dorsal thick, covered with small scales. Eye small, 5 in head. Gill-rakers short, stiff and clavate. Dorsal spines strong, rather low, scarcely exserted, lower than the soft rays, the longest 23 in head: second anal spines 21 in head, stronger than third, scarcely longer; pectorals broad and rounded, the lower rays thickened, the tips reaching vent; ventrals reaching beyond vent; caudal rounded. Peritoneum pale. Head 3; depth 23; pectoral 33. D. XIII-13; A. III, 5; Lat. 1. San Francisco to Cerros Island, abundant southward: one of the most singularly marked of the rock-fishes.

(Sebastichthys serriceps Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 38.)

# 1034. S. nigrocinetus (Ayres) J. & G.

Bright orange-red, with 5 jet-black vertical bars, overlaid with red; these bars comparatively narrow, none of them wider than eye; one at beginning of dorsal, extending downward on opercle and scapular region; a second, broader one, under middle of spinous dorsal; a third under posterior part of spinous dorsal; the fourth narrower, under front of soft dorsal; the fifth under middle of soft dorsal, all of these extending on the dorsal fin; two oblique black bands from eye, downwards and backwards across cheeks; another upwards and backwards towards the nape; fins uniform deep orange, anal and ventrals tipped with blackish; mouth red. Body short, deep, and compressed, deeper than in any of the other species; back arched. Head large, compressed. very large; maxillary extending to beyond pupil, 2 in head; lower jaw very slightly projecting, the symphysis not produced; premaxillary scarcely below eye. Eye large, 41 in head. Cranial ridges higher than in any other species, their spines blunt, the ridges arranged in two nearly parallel series as in S. serriceps, the surface of the larger ones roughened by accessory spinous tubercles as in S. ruber; occipital ridges very high; skin covering cranial ridges thin or obsolete, not lax; interorbital space sparsely scaled, very narrow, its breadth a little more than half diameter of eye, with very strong frontal ridges, which are not covered by the seales; jaws naked; preorbital broad, a low ridge extending along its surface and that of the suborbital; this ridge, somewhat rough and not covered with the scales, is continuous with the short suborbital stay; preopercular spines short, very blunt, the opercular spines very strong; scapular spines moderate. Gill-rakers short and stout, clavate, the longest nearly one-third the diameter of the eye. Dorsal spines rather high and strong, the longest  $2\frac{1}{4}$  in head, about as high as soft rays, the fin not deeply emarginate; caudal fin rounded; anal fin high, its second spine  $2\frac{1}{2}$  in head, higher and much stronger than the third; pectorals broad, fan-shaped,  $3\frac{2}{3}$  in length, their base one-third broader than the diameter of the orbit, their tips not quite reaching tips of ventrals. Scales rough. Peritoneum white. Head  $2\frac{4}{5}$ ; depth  $2\frac{2}{3}$ . D. XIII, 15; A. III, 7; Lat. l. 50. L. 15 inches. San Francisco to Vancouver's Island, in deep water; rare southward. A large and singular species.

(Sebastes nigrocinetus Ayres, Proc. Cal. Acad. Sci. ii, 25, 1859, and 217, f. 67: Sebastichthys nigrocinetus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 278.)

#### 359 .- SCORP ÆNA Linneus.

#### Rascacios.

(Sebastapistes Gill: Parascorpana Bleeker: Pseudosebastes Sauvage: Poutinus Poey.)

(Artedi; Linnæus, Systema Naturæ, 1758: type Scorpæna porcus L.)

Body oblong, somewhat compressed. Head large, not much compressed, usually naked above, and armed with several series of spinous ridges; often with dermal flaps. Mouth large, with bands of villiform teeth on jaws, vomer, and palatines. Scales mostly etenoid, of moderate size, often with skinny flaps. Dorsal fin with 12 stout spines; anal with 3 spines, the second commonly the longest; pectorals large, rounded, the base usually procurrent; the upper rays divided, the lower simple in all our species; ventrals inserted behind pectorals. No airbladder. Vertebræ 10 + 14. Species numerous in the tropical seas; fishes of singular forms and bright colors; the variation in squamation and armature is very great, but if the group be further subdivided, some characters other than those hitherto suggested must be taken. The intergradation of the species of Scorpana and Sebastodes is very perfect. The greater number of dorsal spines and of vertebræ afford the only characters known to us by which Sebastodes may be distinguished from Scorpana. (σχορπαινα, the ancient name of Scorpana scrofa, from σχορπιος, scorpion, in allusion to the dorsal spines, which inflict a very painful sting-like wound.)

- a. Cheeks, opercles, breast, and usually top of head scaly; no pit at the occiput; aspect of Sebastodes. (Pontinus\* Pocy.)
  - b. Dermal flaps none; pectoral fin not procurrent; no exoccipital spines.

## 1035. S. dactyloptera De la Roche,

Color delicate scarlet red, the opercle and dorsal fin somewhat mottled with brownish. Body not much elevated, little compressed. the tail slender. Head large, little compressed; cheeks, opercles, and occipital region well scaled; no dermal flaps anywhere; suborbital stay strong. Mouth rather large, with teeth as usual on jaws, vomer, and palatines; lower jaw not projecting; maxillary extending to beyond pupil. Suborbital with a narrow raised smooth ridge, which ends in a spine at the base of the stay; preorbital narrow, its edge slightly spinous: interorbital space narrow, with two parallel raised ridges and a deep groove. Cranial ridges short, sharp, about as in Sebastodes rosaceus: preocular, supraocular, postocular, tympanic, occipital, and nuchal spines present: suprascapular spines sharp: no exoccipitals: opercular spines moderate; preopercular spines sharp, the second longest. Eye very large, 3 in head. Jaws naked. Gill-rakers rather long and slender. Pectoral very narrow for a Scorpana, the rays not procurrent below nor thickened, reaching anal; ventrals small, reaching past vent; anal small and low, its second spine a little stouter but not longer than third; dorsal low, little emarginate, the spines slender. Scales etenoid, regularly arranged; no accessory seales. Head  $3\frac{1}{5}$ ; depth  $2\frac{9}{5}$ . D. XII 12; A. III, 5; Lat. l. 43. Deep water off Chesapeake Bay; described from a specimen lately taken by the U.S. Fish Commission. It is provisionally identified with S. dactyloptera, of the Mediterranean and Madeira Islands, but it is probably a species distinct from the latter, although closely related.

(De la Roche, Ann. Mus. xiii, 1809, pl. 22, f. 2: Sebastes dactylopterus Giinther, ii, 99: Sebastes imperialis C. & V. iv, 336.)

aa. Cheeks, opercles, and top of head naked; dermal flaps present; pectorals procurrent, a quadrate pit at the occiput. (Scorpana.)

c. Breast sealy. (Parascorpana Bleeker.)

# 1036. S. guttata Grd.—Scorpene; Scorpion; Sculpin.

Brown, irregularly mottled and blotched with rosy purplish and pale olive; opercles and cheeks, a bar behind eye, and 5 or 6 large blotches at base of dorsal, purplish; head, back, and sides with many small

<sup>\*</sup>Poey, Memorias Cuba, ii, 172, 1860: type Poutinus castor Poey. (Latin, pons, bridge; "si l'idée d'un pont formé par les trois premiers sous-orbitaires peut contenter les étymologistes j'en serai bien aise; j'ai déjà dit que les noms les plus savants ne sont pas les meilleurs." Poey.)

round dark olive spots; belly unspotted; thoracic region pink; spinous dorsal blackish, its middle part with many roundish pale spots, forming a continuous stripe, besides smaller black spots; candal and pectoral with vertical bars of dark and pale spots; soft dorsal and anal spotted; ventrals pinkish, little spotted; jaws and branchiostegals vellowish. more or less mottled; axil pale, with round dark spots. Body robust. little compressed; interorbital space not very deeply concave; a pit at the vertex in front of occipital ridges, much broader than long. Monh very broad, little oblique, the lower jaw included; maxillary 2½ in head. reaching posterior margin of orbit. Gill-rakers very short, broad, compressed. Cranial spines bluntish, high; preocular, supraocular, postocular, tympanic, occipital, nuchal, and exoccipital present, besides a bifid spine between the exoccipital and orbit; upper preopercuar spine longest; opercular spines not large; suprascapular spines 3, knife-like; suborbital region without pit, but with a bony carina on which are 2 or 3 bluntish spines. Head naked; breast, and region before pectorals, covered with small imbedded scales (with exception of opercular flap); anterior margin of preorbitals, margin of preopercle, and nostrils with skinny flaps; 1 or 2 rather small flaps above eye, besides several smaller ones on various parts of the head. Scales small, nowhere distinetly etenoid; nearly every scale on the upper parts of body with a small membranous flap. Dorsal spines high, higher than the soft rays. the longest 2½ in head; second anal spine longest and much the strongest, 3 in head; pectoral very broad, short, and rounded, its lower rays procurrent, its tip reaching beyond the ventrals to vent, its base more than \(\frac{1}{3}\) head, its length 3\(\frac{1}{3}\) in body; caudal rounded. Peritoneum white. Head  $2\frac{3}{3}$ ; depth 3. D. XII. 10; A. III, 5; Lat. 1. 30 (tubes); 50–60 seales. L. 12 inches. Coast of California, from Point Concepcion southward; very abundant.

(Grd. Proc. Acad. Nat. Sci. Phila. 1854, 145; Grd. U. S. Pac. R. R. Surv. Fish. 77, pl. 17: Sebastapistes guttatus Gill, in Street's Bulletin, U. S. Nat. Mus. vii, 1877, 62.)

#### 1037. S. plumieri Bloch.—Rascacio.

Olive brown, excessively marbled with silvery and reddish; fins profusely variegated; candal barred with brown and silvery; a dark blotch on spinous dorsal, between the 6th and 7th spines; axil black, with white spots. Body short and thick. Head irregular in form, with numerous grooves and pits, and many fleshy slips; a large deep pit below the eye, between it and the front of suborbital stay; supraocular flap at

least as high as eye: large flaps on preorbital and edge of preopercle. preocular, supraocular, tympanic, coronal, occipital, nuchal, and exoccipital spines present: a deep pit behind coronal spines, as long as broad: preopercular and opercular spines moderate, bluntish, suborbital stay prominent, with 3 or 4 sharp spines; a few scales on preopercle and opercular flap; head otherwise naked; maxillary reaching to behind eye, not quite half head; lower jaw included; breast covered with small imbedded scales; scales of body large, not etenoid, firm, many of them with membranous flaps; lateral line with a series of fleshy flaps. Dorsal low, the highest spine  $2\frac{3}{4}$  in head, somewhat lower than the soft rays; pectorals very broad, procurrent, reaching about to front of anal fin; second anal spine very robust,  $2\frac{3}{5}$  in head, much larger than third. Head 24 in length; depth 3. D. XII, 10; A. III, 5; Lat. 1, 25 (rows of scales); about 40 pores. West Indies and both coasts of Mexico; occasional northward. Here described from specimens from Mazatlan, Mexico.

(Bloch, Nya, Handl. Stockh, x, 234, 1789; Bloch, & Schneider, 1801, 194: Scorpana bufo C. & V. iv, 306; Günther, ii, 113: Scorpana rascacio Poey, Synops. Pisc. Cubens. 303.)

cc. Breast naked.

### 1038. S. porcus Linn .- Pig-foot.

Reddish brown, much mottled above with darker, and dotted with black; much less variegated than in S. plumieri; usually a black blotch on posterior half of spinous dorsal. Body oblong, compressed; back somewhat elevated, highest at origin of spinous dorsal; suborbital stay close to eye, without any pit between it and the eye; supraocular flap broad, a little lower than eye; no flaps on posterior edge of preopercle, four on occipital region, few along lateral line; preocular, supraocular, tympanic, occipital, exoccipital, and nuchal spines present; a pit before occipital spines; opercular and preopercular spines short; maxillary reaching posterior margin of orbit. Scales present on postocular region and upper part of preopercle; scales on body somewhat regularly placed; breast naked. Fins high; pectorals much less procurrent at base than in S. plumieri, reaching beyond tips of ventrals, which reach anal; spines slender, the second anal slender, little longer than third. Gill-rakers short and thick. D. XIII, 10; A. III, 5; Lat. Southern Europe; a specimen said to have been sent to Cuvier from New York.

(Linn. Syst. Nat.; C. & V. iv, 300; Günther, ii, 107.)

#### 360 .- SETARCHES Johnson.

(Johnson, Proc. Zoöl, Soc. Lond, 1862, 11: type Setarches güntheri Johnson,)

As here understood, this genus differs from *Scorpana* in having less than 12 dorsal spines and the scales cycloid, without skinny flaps. Deep-sea fishes. Our species differs from *S. güntheri* in the possession of but ten dorsal spines instead of eleven. (Etymology not obvious.)

# 1039. S. parmatus Goode.

Body stout and deep. Fins high; vertical fins inserted well back, the paired fins well forward. Interorbital width half the length of the upper jaw, about equal to the orbit. Eye moderate, nearly 4 in head. Scales comparatively large, regularly arranged, cycloid, with concentric furrows and no dermal flaps. Cranial ridges developed about as in *Sebastes*. Preopercular spines very long; candal truncate. Pectoral fin long,  $2\frac{1}{7}$  in body. Head  $2\frac{1}{4}$ ; depth  $2\frac{2}{3}$ . D. X, 6+; A. III, 6. (*Goode*.) Deep water off Rhode Island; known from a young specimen.

(Goode, Proc. U. S. Nat. Mus. 1880; 480.)

# FAMILY CVII (a).—COTTIDÆ.

(The Sculpins.)

Body moderately elongate, fusiform or compressed, tapering backward from the head, which is usually broad and depressed. placed high, the interocular space usually narrow; a bony stay connecting the suborbital with the preopercle, usually covered by the skin; upper angle of preopercle usually with one or more spinous processes. Teeth equal, in villiform or cardiform bands on jaws, and usually on vomer and palatines; premaxillaries protractile; maxillary without supplemental bone. Gills 3\for 4; slit behind the last gill small, or obsolete; gill-rakers short, tubercle-like or obsolete; gill-membranes broadly connected, often joined to the isthmus. Body naked, or variously armed with scales, prickles, or bony plates, but never uniformly scaled. Lateral line present, simple. Dorsal fins separate or somewhat connected, the spines usually slender, the soft part elongate; caudal fin separate, rounded; anal fin similar to the soft dorsal, without spines; pectoral fins large, with broad procurrent bases, the rays mostly simple, the upper sometimes branched; ventrals thoracic, rarely entirely wanting, the rays usually less than I, 5. Pseudobranchiæ present, at least in all our species. Pyloric cœca usually in small number (4-8); air-bladder commonly wanting. Genera about 40; species about 150, mostly of the rock pools and shores of northern regions; many species found in fresh waters. The group, as here understood, comprises a considerable variety of forms, and is very difficult to define, as it grades into the *Liparididæ* on the one hand, and into the *Scorpænidæ* on the other. Most of the species are of small size and singular aspect, and none are valued as food. The genera have been probably too much multiplied, and several of them can be only provisionally accepted.

(Triglida, group Cottina, pt.; group Scorpanina, part, Günther, ii; family Psychrolutida Günther, iii, 516, 517.)

a. Spinous dorsal longer than soft part, of more than 14 spines. (Hemitripterina.)

b. Spinous dorsal deeply notched, the anterior spines highest; skin rough, with prickles and tubercles; teeth on vomer and palatines; gill-membrane free from isthmus; no slit behind last gill.

Hemitripterus, 361.

aa. Spinous dorsal shorter than soft part, of less than 13 spines.

c. Ventral fins wanting. (Ascelichthyine.)

d. Skin naked; no slit behind fourth gill; gill-membrane free from isthmus; teeth on vomer and palatines.

ASCELICHTHYS, 362.

cc. Ventral fins present.

- e. Spinous dorsal little developed, continuous with the soft dorsal, the spines slender, concealed in the loose naked skin; gill-membranes broadly joined to the isthmus; no slit behind last gill.

  (Psuchrolutium.)
- - g. Gill-openings extending below at least to the base of lowest pectoral ray. (Cotting.)
    - h. Slit behind last gill obsolete\*; vomer with teeth.
      - Gill-membranes broadly united to the isthmus, not forming a fold across it; head feebly armed; palatine teeth few or none.

Uranidea, 366.

- Gill-membranes free from isthmus, or else forming a broad fold across it; head well armed.
- jj. Palatine teeth none; body without true scales....Cottus, 367.
  hh. Slit behind last gill evident.
  - k. Vomer without teeth; preopercular spine with antler-like processes; gill-membranes forming a fold aeross isthmus...GYMNACANTHUS, 363.
  - kk. Vomer with teeth.
    - 1. Skin not hispid. †

<sup>\*</sup> A round pore in some species of Cottus.

<sup>†</sup> Partly villous in Triglops.

m. Palatine teeth none.

n. Gill-membranes more or less joined to the isthmus, sometimes forming a fold across it.

o. First dorsal spine not elevated.

oo. First dorsal spine elevated; skin perfectly smooth; intestinal canal short. Luccortus, 371.

mm. Palatine teeth present.

q. Gill-membranes joined to the isthmus, sometimes forming a narrow fold across it.

r. Skin perfectly smooth; preopercular spine with antler-like processes; spinous dorsal short, entire......Leptocottus, 373.

aq. Gill-membranes entirely free from the isthmus.

 Sides of back with a band of rough scales; ventral fins very long, armed with sette.
 MELLETES. 375.

88. Sides of back without band of scales.

t. Ventrals I, 5; spinous dorsal long.

SCORP.ENICHTHYS, 376.

tt. Ventrals I, 3; spinous dorsal short.

Oligocottus, 377.

U. Skin everywhere rough with villiform prickles; first dorsal elevated in front; head small, with vertical cheeks.

u. Gill-membranes free from the isthmus;
 ventrals small ..........BLEPSIAS, 378.
 uu. Gill-membranes united to the isthmus;

ventrals well developed.

NAUTICHTHYS, 379.

gg. Gill-opening restricted to the space above the upper edge of the base of the pectoral; skin everywhere with bifid or trifid prickles. (Rhamphocotting.)

v. Snout produced; mouth very small; no teeth on vomer or palatines; head elevated, with two bony ridges.

**RHAMPHOCOTTUS**, 380.

#### 361.-HEMITRIPTERUS Cuvier.

#### Sea Rarens

(Cuvier, Règne, Anim. ii, 1829, ed. 2: type Hemitripterus americanus C. & V.)

Body moderately elongate, scaleless, but the skin covered with prickles and bony protuberances of various sizes and forms. Head large, with numerous bony humps and ridges and fleshy slips above; orbital rim much elevated, the interorbital space deeply concave; a depressed area at the occiput, behind which are two blunt spines on each side. Mouth very wide; jaws, vomer, and palatines with broad bands of teeth; no slit behind last gill; gill-membranes broadly united, free from the isthmus; preopercle with stout, blunt spines; suborbital stay very strong, forming a sharp ridge. Spinous dorsal much longer than the soft part, of 15 to 18 spines, of which the first two are the highest, and the fourth and fifth shorter than the succeeding ones, the fin thus deeply emarginate; pectoral fins very broad, much procurrent; ventrals I, 3. Large fishes of singular appearance, inhabiting the North Atlantic and Pacific.  $(\hat{\chi}\mu\bar{\iota}, \text{half}; \tau\rho\epsilon\iota\bar{\iota}_5, \text{three}; \pi\tau\epsilon\rho\delta\nu, \text{fin.})$ 

# 1010. M. americanus (Gmelin) Cuv. & Val.—Sea Raven.

Reddish brown, marbled with darker brown, and much variegated; yellowish below; fins variegated with light and dark. Body villons, the prickles enlarged and tuberele-like along back and lateral line; nasal spines strong; supraocular ridge much elevated, with dermal flaps and two blunt spines; two pairs of fleshy slips on nasal bones, and two on supraocular ridges; smaller cirri on maxillary, on preorbital, and several on lower jaw; interocular space very deeply concave; two blunt occipital spines on each side, outside of which are two or three others; opercle small, with a bony ridge; preopercle with two blunt spines, below which are one or two others; lower jaw slightly projecting; maxillary reaching beyond eye, about half head; pectorals nearly reaching anal; highest dorsal spine 13 in length of head, as long as caudal; ventrals reaching half way to anal. Head 23; depth 34. D. IV, XII-I, 12; A. 13; Lat. l. 40. Atlantic coast of America; chiefly northward from Cape Cod.

(Scorpæna americana Gmel. Syst. Nat. 1788, 1220: Cottus acadian Walbanm, Artedi Pisc. 1792, 392; Cuv. & Val. iv, 268; Günther, ii, 143: Hemitripterus acadianus Storer, Hist. Fish. Mass. 35.)

#### IOAL, H. cavifrons Lock.

Very similar to the preceding, but with the upper surface of the head more uneven, the concavity of the interocular area more marked, and the dorsal fin with more spines. Head equalling depth, about  $3\frac{1}{2}$  in total length with candal. D. IV, XIV-13; P. 20; V. I, 3; A. 14; Lat. l. 44. L. 16 inches. Kodiak, Alaska; perhaps not distinct from the preceding.

(Lockington, Proc. Acad. Nat. Sci. Phila. 1880, 233: ? Cottus villosus Pallas, Zoogr. Ross.-Asiat. iii, 129, 1811.)

#### 362.-ASCELICITIVS Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 264: type Ascelichthys rhodorus Jor. & Gilb.)

Body plump, fusiform, tapering backward, covered with loose smooth skin; head broad, depressed, its upper surface evenly and weakly convex; a hooked preopercular spine; no nasal spines; a supraorbital cirrus; teeth on jaws, vomer and palatines; no slit behind fourth gill; gill-membranes broadly united, free from the isthmus; spinous dorsal low; the spines slender, almost concealed in the membrane; pectorals broad; rentral fins wanting. Small fishes of the rock pools of the North Pacific. (a, privative;  $\sigma z \epsilon \lambda \sigma z$ , leg;  $i \chi \theta \dot{\sigma} z$ , fish.)

#### 1042. A. rhodorus Jor. & Gilb.

Dark olivaceous, sometimes with saddle-like pale blotches; lips rosy; spinous dorsal dusky, edged in life with bright crimson; other fins dusky, edged with paler, the pectoral slightly barred. Head low, rounded anteriorly; maxillary reaching to posterior border of eye. No scales, prickles, or barbels anywhere, except a fringed cirrus over the eye; preopercle with a short, simple, strongly hooked spine; spines directed downwards and forwards on subopercle and interopercle; lateral line continuous. Dorsal fins connected by membrane, the spines low, weak, nearly uniform; soft dorsal nearly twice as high as spinous; pectorals about reaching vent. Head 3; depth 5. D. IX-19; A. 15; P. 16. L. 5 inches. Pacific coast; Sitka to Cape Mendocino; abundant among rocks between tide-marks.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 264.)

#### 363.-PSYCHROLUTES Günther.

(Günther, Cat. Fish. Brit. Mus. iii, 516, 1861: type Psychrolutes paradoxus Günther.)

Body tadpole-shaped, tapering from the head to the very slender tail, covered with very loose, naked, movable skin. Head large, depressed,

flattish above; snout obtuse, rounded; interocular space very broad, concave, the ocular ridges obsolete; lower jaw projecting; maxillary entirely adnate to the skin of the preorbital; jaws with bands of villiform teeth; no teeth on vomer or palatines; no spines or cirri about the head; suborbital stay narrow, not reaching preopercle. Gill-membranes united to the isthmus; gills 3½, no slit behind the fourth. Branchiostegals 7. Fins connected; spinous dorsal of short, slender, flexible spines, imbedded in the skin and searcely visible; soft dorsal short, the rays close together; anal low; caudal separate; pectoral fins long, with a broad, procurrent base. Ventrals rather long, I, 3, close together, distinct, the base adnate to the body. Small fishes, closely resembling Liparididæ, from which group they are distinguished by no character of much importance. (ψοχρολουτης, one who bathes in cold water.)

### 1043. P. paradoxus Gthr.

Dusky, pale below; sides of head with round pale spots (mucous pores); top of head with dark obscure streaks. Body almost fusiform, tapering from the shoulders to the very slender tail. Head very large, depressed, its bones thin; interocular space two-fifths length of head. Mouth large, the maxillary extending to below posterior margin of eye; premaxillary on the level of pupil; two blunt tubercles behind eye; no spines about head; processes of premaxillary very prominent; isthmus broad. Dorsal long, the spines separated by an emargination from the soft rays, the spines very slender, weak and wide apart, enveloped in thick skin; soft rays close together, much higher than the spines; caudal short, rounded; anal fin similar to soft dorsal, but lower; ventrals about half as long as the pectorals, their rays about 1, 3. Head  $2\frac{2}{3}$ ; depth  $4\frac{1}{2}$ . D. VIII-9; A. 9; C. 12; B. 7. North Pacific; this description taken from a specimen examined by us from Kodiak; the original type from the Gulf of Georgia.

(Günther, iii, 516.)

#### 364.-COTTUNCULUS Collett.

(Collett, Norges Fiske, 1875, 20: type Cottunculus microps Collett.)

Tadpole-shaped, the head extremely large, the body tapering rapidly from the shoulders to the slender tail; mouth rather large, terminal, oblique, the jaws about equal; villiform teeth in the jaws; a double patch on vomer; no teeth on the palatines; no spines on the head, the tubercular surface of the skull covered by skin; skull thin, its bones

not firm. Gills 3½, no slit behind the last arch; gill-membranes broadly joined to the isthmus, their union extending to above the lower edge of the base of the pectorals. Pseudobranchiæ very small; no eirri, scales, or prickles; the skin thin and movable, smooth, or roughened with small warts. Spinous dorsal little developed; the two fins usually continuous; spines very slender, flexible, imbedded in the skin; pectorals short, procurrent below; ventrals very short, well separated, their rays I, 3; caudal rounded. Deeper parts of the Atlantic; very closely related to Psychrolutes. (A diminutive of Cottus.)

# 1044. C. microps Collett.

Pale, with three broad dusky cross-bands on body and fins, one on head, one through spinous dorsal and pectoral, one through second dorsal and anal, besides a small band at base of caudal. Head very large, its length, breadth, and depth nearly equal; the greatest depth at the nape; four bony tubercles on top of head and some at the sides, all covered by the skin; lower jaw included; maxillary extending to below the middle of the eye, which is equal to the snout, and about 41 in head; suborbital stay and the roughish edge of the preopercle both covered by smooth skin; chin and preorbital with pores. Skin everywhere thin, somewhat movable, its surface roughened by small blunt Dorsal fin continuous, the feeble spines lower than the soft rays; pectorals barely reaching anal; caudal long. Head  $2\frac{2}{3}$ ; depth 31. D. VI-19; A. 10. L. 8 inches. Deep water off the coasts of Norway and of Rhode Island; lately taken by the United States Fish Commis-The specimens here described by us differ somewhat from Collett's description, but the very small size of the original types may perhaps account for the discrepancies.

(? Collett, Norges Fiske, 1875, 20, pl. 1; Goode, Proc. U. S. Nat. Mus. 1880, 479.)

#### 1015. C. torvus Goode.

Color yellowish, the fins all dusky; no cross-bars. General form and appearance of *C. microps*, but the head still larger, and the skin perfectly smooth, very thin, loose, and movable as in *Liparis*. Tubercles on head stronger, more numerous, covered by skin, but more spine-like, the bones firmer; spinous dorsal still feebler and more concealed. Head  $2\frac{1}{2}$ ; depth  $3\frac{1}{2}$ . D. VII-14; A. ca. 15. L. 6 inches. Deep water off the coast of Rhode Island; lately taken by the United States Fish Commission.

(Goode, Proc. U. S. Nat. Mus. 1880, 479; name only.)

### 365.—ICELUS Kröver.

(Kröver, Naturhist, Tidsskr. i. 253, 1844: type Icelus hamatus Kröver.)

Body fusiform, naked, or variously covered with rough scales or plates, which are permanent and alike in both sexes; skin otherwise smooth. Mouth rather large; teeth on vomer and palatines. Head naked or scaly, usually with cirri; preopercular spine hooked, branched, or forked. Gill-membranes broadly united, free from the isthmus; no slit behind fourth gill; ventral rays I, 3. North Atlantic and Pacific; the species differing greatly in appearance and armature. (είχελο5, resembling.)

- \*Skin more or less scaly.
  - a. Spinous dorsal not emarginate.
    - b. Top of head and interorbital area convex and nearly smooth; head naked. (Artedius\* Girard.)

# 1046. I. lateralis (Grd.) J. & G.

Dark clear olive-green; head reddish-shaded, the back with sharply defined cross-blotches, alternately dark olive and pale; lower half of sides usually with numerous small pale spots; belly bluish; fins barred with different shades of olive, reddish brown, and black; northern speeimens with a black spot on the front of the spinous dorsal; below it a scarlet crescent, bordered with yellow. Body rather slender, little compressed. Head long and low, less deep than in the other species; occipital region almost flat; interocular space much narrower than the eye. Eye shorter than snout, nearly 5 in head; skin of head everywhere perfectly smooth, its upper surface with numerous small conspicuous pores, and many slender small eirri; no distinct supraorbital cirrus, and no occipital ridges; nasal spines small. Month very large, the jaws nearly equal, the maxillary extending to below the posterior edge of the eye, its length about half that of the head; preopercular spine very small, covered with the skin, forked at tip. Dorsal band of scales narrow, of about 8 rows anteriorly, 2 or 3 posteriorly. line anteriorly, with small cirri. Dorsal spines very slender, the first two shorter than the others; pectorals reaching front of anal. Head 23; depth 5. D. IX-16; A. 13; V. I, 3; scales about 28 in a longitu-

<sup>\*</sup> Girard, Proc. Acad. Nat. Sci. Phila, 1856, 134: type Scorpanichthys lateralis Girard. Dedicated to Petrus Artedi, the "father of Ichthyology," the ablest student of fishes before Cuvier.

Bull. Nat. Mus. No. 16-44

dinal series. L. 5 inches. Rock-pools; from Puget Sound to San Luis Obispo; not common.

(Scorpanichthys lateralis Grd. Proc. Acad. Nat. Sci. Phila. 1854, 145: Artedius lateralis Girard, U. S. Pac. R. R. Sury, Fish. 70: Artedius lateralis Günther, ii, 174.)

- bb. Top of head uneven; interorbital area concave.
  - c. Head with stellate scales above.

# 1047. I. notospilotus (Grd.) J. & G.

Olivaceous, often tinged with purplish, and much variegated; a black bar at occiput: another from middle of spinous dorsal to the axil; one under front of second dorsal extending obliquely forwards; one under posterior part of second dorsal; one on caudal peduncle; bars and interspaces everywhere finely reticulated and mottled; lower parts dusky, with brassy tinge, often with dark reticulations around whitish spots; branchiostegals blackish, with vellow tinge; fins all variegated, the lower fins generally dusky; a black spot occilated with orange between first and second dorsal spines, sometimes a duller one between third and fourth; a large black spot between sixth and eighth spines. short and broad, its vertex depressed; nuchal region with a cross-ridge, in front of which is a quadrate depression; two blunt tubercles behind each eye, armed at tip with small spines; behind these two others without spines, on the occipital ridges; each of these spines with a small cirrus; a small cirrus above posterior part of eye; a minute one on the maxillary; interorbital space deeply concave, the supraocular ridges Eve very large,  $4\frac{2}{3}$  in head. Mouth moderate, broad, the maxillary extending to beyond the pupil, its length nearly half that of the head; suborbital stay strong; preoperele with a strong process, bifid at tip, and with one or more upward-directed spines; below this three blunt serrated processes or multifid spines; vertex, temporal region, interorbital space, and opercles covered with small, detached, stellate scales, strongly spinous at their edges; these smaller than the Head  $2\frac{3}{4}$ ; depth  $4\frac{3}{4}$ . D. IX-15; A. 11 or scales of the dorsal band. L. 10 inches. Northern specimens represent a marked variety, the color paler, the head more scaly, and the edge of the preopercle without serrated processes. D. IX-17; A. 12. Pacific coast; abundant at Santa Barbara and in Puget Sound; not found in rock-pools.

(Calycilepidotus lateralis Ayres, Proc. Cal. Acad. Sci. 1856, 77: Artedius notospilotus Grd. Proc. Acad. Nat. Sci. Phila. 1856, 134, and U. S. Pac. R. R. Surv. Fish. 71: Artedius notospilotus Günther, ii, 174.)

ec. Head without developed scales.

d. Upper preopercular spine hooked, bifurcate. (Icelus.)

### 1048. I. hamatus Kröver.

:6

Yellowish, with many brown spots. Head large, naked; upper preopercular spine small, hooked upwards, bifurcate; 3 spines below it, two of them hooked upwards; two blunt occipital spines; vertex depressed. Skin of body above with warty scales and small prickles; some rows of bony scales from neck to base of caudal; a series of tubercles along lateral line; sides of body with scattered scales; interocular space very narrow, its width 4 in eye; dorsals separated; pectorals shorter than head; no air-bladder; gill-membranes broadly joined, free from isthmus; no slit behind last gill. D. IX-20; A. 16; V. I, 3. Arctic Seas, Alaska to Spitzbergen.

(Kröyer, Naturhist, Tidsskr. i, 253, 1844; Günther, ii, 172.)

dd. Upper preopercular spine long, with 5 hooked processes.

### 1049. I. quadriseriatus (Lockington) J. & G.

Pale olivaceous, somewhat mottled; lateral line with dark blotches: branchiostegal region black in the males; a black bar at base of caudal; a black spot at front of spinous dorsal, and one at tip of the last spine; pectorals with a dark spot at base; other fins olivaceous. little variegated. Body slender, little compressed, tapering from the shoulders to the slender tail. Mouth moderate, the maxillaries reaching about to middle of pupil; a pair of ridges on the occiput, each ending in a spine, the space between them concave; interocular space very narrow, grooved; upper preopercular spine very long, armed with about 5 hooks, all but one directed upwards; below this three simple spines. Head naked or very nearly so, with conspicuous mucous pores above and a few minute cirri. Dorsal fins separated; pectorals broad, about reaching anal; ventrals very small. Lateral line with a series of spinous plates; above it along the back a double series of spinous plates placed at an angle, the upper plates with the free edge downward and backward, the lower plates with the free edge upward and backward; this band composed of a single series before and behind, and not extending around the dorsal in front; skin otherwise perfectly smooth. Head 3½; depth 5½. D. VIII-13; A. 12; V. I, 3. L. 3 inches. Deep waters off San Francisco; locally very abundant.

(Artedius quadriseriatus Lockington, Proc. U. S. Nat. Mus. 1879, 330.)

aa. Spinous dorsal fin deeply emarginate; head scaly. (Chitonotus\* Lockington.)

<sup>\*</sup>Lockington, Proc. U. S. Nat. Mus. 1881, 141: type Chitonotus megaeephalus Lock. ( $\chi i \tau \acute{\omega} \nu$ , a rough cloak;  $\nu \widetilde{\omega} \tau o \varepsilon$ , back.)

### 1050. I. megacephalus (Lock.) J. & G.

Color pale olivaceous with darker cross-bars: fins in the male, blackish: ventrals and anal whitish, unmarked; eye dusky above. fusiform: head long; eyes large, separated by a very narrow, slightly concave interorbital space: mouth large, the maxillary extending to posterior border of eye; preopercle with a strong process armed with 3 or 4 upward-directed and 1 horizontal point; below this 3 other spines; two or three spines close behind eye on each side; two occipital ridges, ending in spines, the space between them concave; top of head, interocular space, snout, upper part of opercle, and a narrow belt close under the eye covered with rough scales; lateral line with a series of quadrate plates, their upper and posterior edges strongly serrate, the lower and anterior edges imbedded; above these the back is evenly covered with smaller scales, the lower and anterior part of each scale imbedded, and the upper edge strongly toothed; 5 to 8 rows of these scales: a narrow naked area at base of dorsal. Dorsal spines slender, the first usually longer than head, reaching past front of soft dorsal when depressed; the second and third spines progressively shortened; the 4th higher than third, the membrane between third and fourth deeply emarginate: second dorsal high; pectorals reaching past front of anal; ventrals to vent; anal papilla very large; no conspicuous cirri. Head  $2\frac{3}{4}$ ; depth  $5\frac{1}{4}$ . D. III, VII-15; A. 15; V. I, 3; Lat. l. 38. L. 6 inches. Off San Francisco, in deep water, locally abundant; possibly a variety of the next.

(Chitonotus megacephalus Lockington, Proc. U. S. Nat. Mus. 1881, 141.)

# 1051. I. pugettensis (Steind.) J. & G.

Coloration of the preceding. Body slender, stouter than in I. megacephalus; head shorter and broader; the mouth also shorter, the maxillary not reaching posterior margin of eye; interorbital space extremely narrow, narrower than in I. megacephalus; squamation and armature of head and body precisely as in I. megacephalus. Dorsal lower than in I. megacephalus, the first dorsal less deeply notehed; the first spine little higher than the second, its tip not reaching to the end of the fin, its total length less than half that of the head; soft dorsal high, higher than first dorsal spine. Head 3; depth  $4\frac{2}{3}$ . D. III, VII-15; A. 15; V. I, 3; Lat l. 37. L. 6 inches. Puget Sound.

(Artedius pugettensis Steindachner, Ichth. Beiträge, v, 133.)

\*\* Skin naked, smooth.

# 1052. I. \*uncinatus (Reinh.) Kröyer.

Olivaceous, mottled and barred with darker, above and on fins. Head broad; lower jaw included; palatine teeth well developed; maxillary extending to opposite middle of pupil. Eyes very large, separated by a narrow ridge; oeciput with two blunt ridges, in front of which the vertex is concave; upper preopercular spine large, strongly hooked upward, more than half length of eye; downward-directed spine on preopercele long and sharp; skin perfectly smooth. Pectorals reaching front of anal; spinous dorsal rather high; vent midway between snout and middle of caudal. Head 3; depth 4½. D. VIII-13; A. 11. L. 4 inches. Cape Cod to Greenland, in deep water; abundant.

(Cottus uncinatus Reinh, Vid. Selsk, Natur, og Math. Afhandl, 1833, 44: Centridermichthys uncinatus Günther, ii, 172: Icelus uncinatus Kröyer, Naturh. Tidsskr, 1844, 253.)

# 1053. I. (?) bicornis (Reinh.) J. & G.

Occiput with two acute points; four preopercular spines, the uppermost of which is bifureate. Skin not described. D. VIII-15; A. 14. Greenland. (Günther.)

(Cottus bicornis Reinh, Vidensk, Selsk, Natur, og Math, Afh, viii, lxxxv: Centridermichthys bicornis Günther, ii, 172.)

# 366.-URANIDEA Dekay.

#### Miller's Thumbs.

(Cottus and Cottopsis Girard.)

(Dekay, New York Fauna, Fish., 1842, 61: type Uranidea quiescens Dekay = Cottus gracilis Heckel.)

Fresh-water sculpins. Body fusiform. Head feebly armed, the preopercular spines covered by the skin; skin smooth or very nearly so; villiform teeth on jaws and vomer, none on palatines. Gillopenings separated by a wide isthmus, over which the membranes do not form a fold; no slit behind fourth gill. Branchiostegals 6. Dorsals nearly or quite separate, the first of 6-9 slender spines; ventrals 1, 3, or I, 4. Fishes of small size, inhabiting clear waters in the northern parts of Europe, Asia, and America. The species are extremely nu-

<sup>\*</sup>This species should form the type of a distinct genus if the current genera of this group are to be recognized. The Japanese genus Centridermichthys Rich. to which this species and many others of our Cottoids have been referred, differs from I. uncinatus in having the slit behind the last gill developed, and the gill-membranes fully united to the isthmus.

merous, and are very difficult to distinguish, all being very similar in form and coloration. The relations of this genus to  $\acute{C}ottus$  are very close. ( $\acute{a}v\rho av\dot{c}z$ , the sky;  $\varepsilon \iota \delta \omega$ , to look.)

- a. Palatines with teeth; ventrals I, 4 (except in 1059).
  - b. Preopercular spine large, strongly hooked; skin above with coarse prickles. (Tauridea\* Jordan & Rice.)

### 1054. U. spilota Cope.

Olivaceous, finely speckled and mottled with darker; belly white; fins mottled. Body contracted at front of anal, subterete posteriorly. Head very broad and flat; no occipital prominences; preopercular spine extremely large, as long as eye, hooked upward; below it are three small spines directed downwards; subopercular spine strong; space above lateral line behind head, covered with small stiff prickles, coarser than in U. aspera and farther apart, slightly hooked backward; no spines behind axil; isthmus broad, the gill-membranes fully joined to it, not forming a fold. Head  $3\frac{3}{5}$ ; depth  $5\frac{1}{3}$ . D. VIII-17; A. 12. Great Lakes, in deep water, and northward to Hudson's Bay.

(Uranidea spilota Cope, Proc. Acad. Nat. Sci. Phila. 1865, 82: Cottopsis ricei Nelson, Bull. Ills. Mus. Nat. Hist. 1876: Tauridea spilota Jordan, Man. Vert. E. U. S. 255: Cottopsis spilotas Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 81; Bean, Proc. U. S. Nat. Mus. 1881, 127; specimens from near Hudson's Bay, said to have no palatine teeth.)

- bb. Preopercular spine small, more or less perfectly concealed in the skin.
  - e. Skin almost everywhere villous. (Cottopsis † Girard.)

# 1055. U. aspera (Rich.) J. & G.

Grayish olive, much mottled and barred; fins finely variegated; usually a large black blotch on posterior part of spinous dorsal. Body rather stout, compressed behind. Head rather broad, transversely convex; opercle and preopercle with the usual spines, all small and nearly concealed in the skin; interorbital space broad and flattish, broader than eye (in adults); skin covered with small close-set prickles, forming a villous covering, the prickles smaller, stiffer, and more closely set than in the next species; head, belly, caudal peduncle, and space along dorsal smooth, or nearly so; pectorals reaching anal; ventrals, I, 4, nearly reaching vent; dorsal spine slender; lateral line complete, angularly bent below last rays of second dorsal. Head 3; depth 4½. D. X-21; A. 18. L. 10 inches. Streams west of the Sierra Nevada

<sup>\*</sup>Jordan & Rice, Man. Vert. E. U. S. ed. 2, 1878, 255: type Cottopsis ricei Nelson.  $(\tau c w \rho \alpha, cow; \epsilon \iota \delta \epsilon \alpha, appearance.)$ 

<sup>†</sup>Girard, Proc. Bost. Soc. Nat. Hist. iii, 303, 1850; type Cottus asper Rich. (κοττος, Cottus; δψίς, appearance.)

and Cascade Mountains; abundant; specimens from the Sacramento River (var. parvus) smaller in size, paler in color and with the interorbital space concave, narrower than eye.

(Cottus asper Rich, Fauna Bor.-Amer. Fish, 295, 1836: Trachidermus richardsoni; Heckel, Ann. Wiener Mus. 1840, 162: Centridermichthys asper Günther, ii, 170: Cottopsis asper Grd. U. S. Pac. R. R. Surv. Fish, 51: Cottopsis parrus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 144: Centridermichthys parrus Günther, ii, 170.)

# 1056. U. semiscabra (Cope) J. & G.

Olivaceous, barred and spotted as in other species; fins mottled; spinous dorsal pale at base and tip, with a median broad black band; two dark blotches at base of caudal. Form of U. aspera, but slenderer. Skin\* of top of head and entire body, except lower part of caudal peduncle, thickly covered with papillæ; those of anterior and upper parts of body each tipped with a spine, many of those on head with median pores; top of head with a median lengthwise depression. Head narrowed anteriorly, the maxillary extending to beyond pupil; opercular and preopercular spines as in U. aspera; lateral line not complete; spinous dorsal low; soft dorsal and anal high; caudal long; pectorals about reaching anal; ventrals rather broad, reaching half way to anal. Eye  $4\frac{1}{2}$  in head. Head  $3\frac{1}{3}$ ; depth  $4\frac{1}{4}$ . D. VII-18;  $\Lambda.$  14; V. I, 4. L. 4 inches. Fort Hall, Idaho (Cope). Utah Lake (Jordan).

(Cottopsis semiscaber Cope, Hayden's Survey, Montana, for 1871-'72, 476: Cottopsis semiscaber Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 459.)

cc. Skin smooth, or prickly in or behind the axil only. (Potamocottus † Gill.)

### 1057. U. gulosa (Grd. ) J. & G.

Olivaceous, variously mottled and barred; fins clouded with darker. Form rather robust. Mouth moderate, the maxillary reaching to pupil; palatine teeth evident. Eyes small, little wider than the interorbital space; preopercular spine short; spinous dorsal low; pectoral fins about reaching anal; ventrals I, 4, not to vent. Head 3; depth 5. D. IX-21; A. 15-17 (Washington); D. VIII-20; A. 18 (California). L. 6 inches. Rivers from California to British Columbia; not rare. California examples have the axillary prickles developed as usual in *U. richardsoni*; all of them within the space covered by pectorals when depressed. Specimens from Vancouver's Island and about Port Townsend have these prickles forming a considerable band, and extending

<sup>\* &</sup>quot;Skin prickly above the lateral line; smooth below it posteriorly." (Cope.) † Gill, Proc. Bost. Soc. Nat. Hist. viii, 40, 1861: type Collus punctulatus Gill. (ποταμος, river; ποττος, sculpin.)

backward on both sides of the lateral line to the middle of the second dorsal, the band narrower and the prickles smaller posteriorly.

(Cottopsis gulosus Grd. Proc. Acad. Nat. Sci. Phila. 1854, 129: Centridermichthys gulosus Günther, ii, 170.)

# 1058. U. punctulata (Gill) Cope.

Light olivaceous; body covered with small black spots, which become larger and more scattered behind; soft dorsal, pectorals, and caudal thickly spotted; spinous dorsal without dark blotch. Head long and wide. Mouth quite large; maxillary reaching past front of orbit; preopercular spine strong, directed obliquely backward and upward. Head 3; depth 5. D. VIII-17; A. 13. (Gill.) Bridger's Pass; distinguished from the other species by the speckled coloration.

(Potamocottus punctulatus Gill, Proc. Bost. Soc. Nat. Hist. 1861, 40, and in Ichth. Capt. Simp. Expl. 1876, 402.)

# 1059. U. bendirei (Bean) J. & G.

Uniform dark brown above, lighter below. Maxillary extending just beyond front of eye; eye 4 in head; preopercle with 4 spines, the upper one half as long as the eye. Pectorals reaching origin of anal; ventrals not to vent. Depth 4. D. VIII-16; A. 12; V. I, 3. Walla-Walla, Wash. (Bean.)

(Potamocottus bendirei Bean, Proc. U. S. Nat. Mus. 1881, 27.)

# 1060. U. richardsoni (Agassiz) J. & G.—Miller's Thumb; Blob; Muffle-jaw; Bull-head.

Olivaceous, more or less barred and speekled with darker; fins mostly barred or mottled. Body slender or stout, tapering regularly backward to the tail; vertex somewhat depressed; interocular space with a groove; preopercle with a short sharp spine, little hooked. directed backwards and upwards, mostly covered by the skin; below this are 2 smaller concealed spines; subopercle with a stoutish spine, directed forwards. Skin smooth, except the region immediately behind the pectorals, which is beset with very small sharp prickles which are sometimes obsolete; lateral line conspicuous, continuous or interrupted behind; first dorsal low and feeble; pectoral fins large, their length nearly equal to that of the head, their tips usually reaching beyond the origin of the soft dorsal; ventral fins moderate; isthmus very broad, the gill-membranes not forming a fold across it. Head  $3\frac{1}{3}$ ; depth 4-5. D. VI to VIII-16 or 17; A. about 12; V. I, 4. L. 3-7 inches. Middle and Northern States, abounding in all clear rocky brooks and lakes: extending southward along the Alleghanies to Alabama.

Note.—As here understood, a wide-spread and abundant species, varying in different regions, as is the case with most non-migratory species. In this as in others of similar range, the inhabitants of each stream may show local peculiarities. A number of these forms have received from Dr. Girard specific names, which are accompanied by detailed descriptions. Large collections of these tishes show that numerous similar "species" still exist undescribed, as it is a rare thing to find a specimen which exactly agrees in all respects with any of the species in Dr. Girard's "Monograph of the Fresh-Water Cottoids." The following forms, of all of which the writers have specimens, may possibly be recognized as "varieties," but of their complete intergradation we have no doubt:

Var. richardsoni (Ag.) is rather slender, with the vent rather more posterior than usual, placed midway between the snout and the tip of the caudal; in the others it is nearly midway between the snout and the middle of the caudal. Wisconsin to Lake Superior.

(Cottus richardsoni Agassiz, Lake Superior, 1850, 300: Cottus richardsoni Girard, Monograph Fresh-Water Cottoids N. A. 39: Cottus richardsoni Günther, ii, 158)

Var. bairdi (Girard) is small and slender, with the spinons dorsal very low, and the palatine teeth less developed than in the other forms. Cayuga Lake, N. Y., to Ohio.

(Cottus bairdii Girard, Proc. Amer. Assoc. Adv. Sei. ii, 1850, 410, and Mon. Cott. 44.)

Var. wilsoni (Grd.) is rather stouter, with stronger palatine teeth, and with some of the uppermost of the pectoral rays bifurcate, these being entire in the others. Ohio Valley, Pennsylvania, and Indiana.

(Cottus wilsoni Grd. l. e. 42.)

Var. alvordi Grd. is short and clubby, with the first dorsal rather high, and joined by membrane to the second more than in other forms. Common in Wisconsin and Michigan.

(Cottus alvordi Grd. l. c. 46.)

Var. meridionalis (Grd.) is rather robust, with the dorsal fins scarcely connected, and the mouth rather larger, the maxillary extending to opposite posterior border of eye; the preopercular spine is sharp and directed well upward. Pennsylvania to North Carolina, along the Alleghanies; abundant.

(Cottus meridionalis Girard, Proc. Amer. Assoc. Adv. Sci. ii, 1850, 410, and l. c. 47.)

Var. zophera (Jor.) is slender and very dark in color, and more conspicuously variegated; the first dorsal high; the palatine teeth well developed. Alabama River.

(Potamocottus zopherus Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 320.)

Var. carolinæ (Gill) is a very large form, rather robust, reaching a length of nearly six inches, without axillary prickles, and with the palatine teeth well developed. The lateral line, as in the other forms, is sometimes continuous and sometimes interrupted. It abounds in the limestone region from Indiana to Tennessee, and is frequently found in caves.

(Potamocottus carolinæ Gill, Proc. Bost. Soc. Nat. Hist. 1861, 40: Potamocottus carolinæ Gill, Simps. Rept. Ichth. Utah, 1877, 403.)

#### 1061. U. wheeleri Cope.

Body slender, entirely smooth. Head not broad; maxillary reaching pupil. Lateral line deflexed below dorsal. Eye large, 5 in head; isthmus as wide as distance from pupil to snout; preopercular spine strong. Pectoral longer than head, reaching past front of anal, longer than usual in *U. richardsoni*. Head 3; depth  $6\frac{3}{4}$ . D. VII-17; A. 12; P. 15,

its rays all simple. Utah and Western Colorado, abundant; not evidently different from the preceding.

(Uranidea wheeleri Cope, Proc. Amer. Phil. Soc. Phila, 1874, 138: Uranidea wheeleri Cope & Yarrow, Zoöl, Wheeler's Expl. W. 100th Mer. v, 696.)

aa. Palatine teeth obsolete. (Uranidea.)c. Ventral rays I, 4.

# 1062. U. cognata (Rich.) J. & G.

Apparently similar to the European *Uranidea gobio*, and distinguished from most of the American species by having the ventral rays 1,4. Skin smooth; pectorals as long as head; preopercular spine small curved upwards. D. VIII-18; A. 14. Great Bear Lake (*Richardson*); perhaps the same as the next.

(Cottus cognatus Richardson, Fauna Bor.-Amer. iii, 1836, 40: Cottus cognatus Girard, l. c. 41, and Günther, ii, 157.)

# 1033. U. mimuta (Pallas) J. & G.

Olivaceous, finely variegated and speckled; fins above speckled. Body long and low, little compressed. Head rather small, wider than deep. Mouth short, comparatively small, the maxillary extending little beyond front of orbit; mandible included; preopercular spine sharp, straight. First dorsal low, the spines nearly even; pectorals reaching about to vent; ventrals not to vent; skin entirely smooth. Head 4; depth 4½. D. VIII-19; A. 14; V. I, 4; Lat. l. 36. L. 5 inches. Aleutian Islands. Perhaps a variety of the European *U. gobio*.

(Cottus minutus Pallas, Zoogr. Rosso.-Asiat. iii, 145, 1811-1831: Uranidea microstoma Lockington, Proc. U. S. Nat. Mus. 1880, 58: not Cottus microstomus Heckel.)

ce Ventral rays I, 3.d. Anal rays 14 or 15.

# 1064. U. marginata Bean.

Olivaceous, blotched, the fins punctulate; first dorsal dark, with a distinct pale margin. Body stontish. Head broad, slightly depressed; maxillary reaching to anterior third of orbit; preopercular spine short, bluntish; below this one or two smaller ones; vent nearer base of caudal than snout. Head 3; pectoral 4 in length; ventrals 6. D. VII or VIII-18 or 19; A. 15; V. I, 3. Walla Walla, Washington. (Bean.) (Bean, Proc. U. S. Nat. Mus. 1881, 26.)

### 1065. U. viscosa (Hald.) Jor.

Olivaceous, variegated, the spinous dorsal edged with orange in life; fins mostly barred. Body rather stout; mucous pores on head unusually numerous. Mouth small; maxillary reaching middle of eye; pre-

ocular spine acute, extremely short, directed obliquely upwards; isthmus rather narrow; first dorsal low, slightly connected with second; pectorals shorter than head, reaching second dorsal. Head  $3\frac{1}{2}$  in length; depth  $4\frac{3}{4}$ . D. VI-18; A. 14; V. 1, 3. Pennsylvania and Maryland.

(Cottus riscosus Haldeman, Suppl. Monogr. Limnea 1842, 3: Cottus riscosus Girard, l. e. 51.)

dd. Anal rays 11 or 12.

### 1066. U. gracilis (Heckel) Putu.

Olivaceous, mottled, upper edge of spinous dorsal red in life. Body rather slender, fusiform; preocular spine moderate, concealed. Mouth rather large, the maxillary reaching nearly to the pupil; pectorals reaching front of anal; ventrals about to vent. Head 3½; depth 5. D. VIII-16; A. 12. Streams of New England and New York; not rare.

(Cottus gracilis Heckel, Ann. Wien Mus. ii, 148, 1837: Cottus gracilis Girard, l. c. 49; Cottus gobio Ayres, Bost. Journ. Nat. Hist. v, 121, 1845: Uranidea quiescens De K. New York Fanna, Fish. 1842, 61.)

# 1067. U. gobioides (Girard) Jor.

Similar to the preceding, but larger and more robust, the mouth larger, reaching to beyond the line of the pupil, and the pectorals short, not quite reaching anal; preopercular spine stout, curved suddenly upwards. Head  $3\frac{1}{2}$ ; depth  $4\frac{3}{4}$ . D. VII-17; A. 12. L. 4 inches. Tributaries of Lake Champlain. (Girard.) Probably a variety of U. gracilis.

(Cottus gobioides Girard, Proc. Amer. Assoc. Adv. Sci. 1850, 41, and l. c. 55.)

# 1068. U. boleoides (Girard) Jor.

Slender, sub-fusiform. Mouth rather large, the maxillary extending to opposite the pupil; preopercular spine acute, directed obliquely upwards; isthmus narrow. Fins larger than in any other species; pectorals reaching fourth ray of anal. Head 3½; depth 5½. D. VIII-17; A. 11. L. 3¼ inches. Connecticut Valley in Vermont. (Girard.)

(Cottus boleoides Girard, Proc. Amer. Assoc. Adv. Sci. 1850, 411, and I. c. 56: Cottus boleoides Günther, ii, 159.)

# 1069. U. franklini (Agass.) Jor.

Olivaceous, mottled; both dorsals and anal with a broad dark bar on the distal half; pectorals and candal broadly blotched with dusky. Jaws equal; preopercular spine stout, short, pretty strongly hooked upwards and inwards; first dorsal rather high, not much lower than sec-

ond; peetorals short, not reaching anal; axil prickly, as in species of *Cottopsis*. Head 3½; depth 5. D. VIII-17; A. 11 or 12. Great Lakes, mostly in deep water.

(Cottus franklini Agassiz, Lake Superior, 1850, 303: Cottus franklini Girard, l. c. 53: Cottus franklinii Giinther, ii, 158: ? Cottus formosus Girard, l. c. 58: Uranidea kumlienii Hoy, MSS.; Nelson, Bull. Ills. Mus. Nat. Hist. 1876, 41: Uranidea kumlienii Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 64.)

# 1070. U. hoyi Putnam.

Grayish olive, speckled and barred. Body rather slender. Female with the anterior parts of body and region above lateral line covered with sparse prickles; male apparently smooth. Head narrowed forwards; jaws narrow, about equal; maxillary reaching front of pupil; preopercular spine prominent, longer than pupil, sharp, almost straight, directed backwards and but little upwards; below this is another sharp, prominent spine, also nearly straight, directed partly downwards; 1 or 2 minute concealed spines still lower; pectoral fins reaching vent. D. VI-15; A. 11; V. I, 3. L. barely 2 inches. Lake Michigan, in deep water; the smallest species, well distinguished by its preopercular spine.

(Putnam MSS, Nelson, Bull. Ills. Mus. Nat. Hist. 1876, 41; Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 63.)

## 367.-COTTUS\* Linnaus.

(Acanthocottus Girard.)

(Artedi; Linnaus, Syst. Nat.: type Cottus scorpius L.)

Body rather slender, subfusiform, covered with thick skin, in which are sometimes imbedded prickly plates, especially along lateral line; deciduous granular tubercles also sometimes present, but no true scales. Head large. Mouth terminal, large, the lower jaw included; villiform teeth on the jaws and vomer, none on the palatines; suborbital stay strong; preopercle with 2 strong straight spines above directed backward, and 1 below directed downward and forward; opercle, nasal

<sup>\*</sup> Cottus mertensi Cuv. & Val.

Yellowish, with dark marblings; spines of first dorsal rather strong; head smooth; point of preopercle not reaching opercle. D. VIII-15; A. 12; C. 10; P. 18. Kamtschatka. (Cuv. & Val.)

<sup>(</sup>Cuv. & Val. iv, 496, from a drawing.)

Cottus marmoratus Cnv. & Val.

Brownish, &e., much marbled; fins variegated; first dorsal with a large black spot; 2 strong spines before the eye; 2 short spines on the preopercle; a rather strong spine on opercle; dorsal spines rather strong. D. VIII-14; A. 12; C. 14. Kamtschatka. (Cur. & Val.)

<sup>(</sup>Cuv. & Val. iv, 497, from a drawing.)

bones, orbital rim, and shoulder girdle usually armed; gill-membranes forming a fold across the rather narrow isthmus; slit behind last gill small or wanting, often reduced to a mere pore; vertebrae about 28. Branchiostegals mostly 6. Dorsal fins 2, separate, the first short, its spines rather slender; ventral rays usually I, 3. Species numerous in the seas of northern regions. (zόττος, the ancient name of Uranidea gobio, from zόττος, head.)

a. Head with small tentacles; lateral line with distinct plates.

# 1071. C. bubalis Euphrasen.—Father-lasher.

Colors variegated, the dark markings sometimes red. Head broad, depressed, covered with soft skin, in which are many mucous pores; maxillary reaching past middle of orbit; upper preopercular spine straight, slightly longer than eye; opercular spine granulated at base; small cirri above eye and elsewhere on head; usually one on end of maxillary; eranial bones mostly covered by skin; lateral line with some bony plates, which are most distinct anteriorly; these are very mach smaller than in  $Enophrys\ bison$ ; interocular space very narrow, its ridges continuing backward, serrated, each ending in a sharp spine; no trace of slit behind last gill; spinous dorsal low; anal small; pectorals reaching front of anal; ventrals moderate. Head  $2\frac{2}{3}$ ; depth  $3\frac{2}{3}$ . D. VIII-12; A. 9; Vertebræ 12 + 17. Arctic Europe; said to stray to Greenland.

(Enphrasen, Nya Schwed, Abhandl. 1786, 64; Günther, ii, 164; Day, Fish. Gt. Brit. Ireland, 1880, 51.)

aa. Head without tentacles; lateral line unarmed or with concealed plates.

# 1072. C. octodecimspinosus Mitch.

Olivaceous, with transverse dark bars, paler below; fins barred and mottled; ventrals plain. Body very slender, tapering backward to the long and slender caudal peduncle. Head long and narrow; mouth moderate; maxillary not extending past eye, 24 in head. Upper preopercular spine extremely long, longer than eye, extending beyond tip of opercular spine, its length more than 4 times that of the spine below it; a strong spine at upper posterior margin of orbit directed upward and backward; occipital ridges long, low, converging behind, each ending in a similar spine. Vertex nearly flat. Eye very large, as long as snout, 4½ in head, much wider than interorbital space; nasal spines sharp. Skin usually without rough tubercles; lateral line with a series of partly concealed plates. Spinous dorsal higher than soft dorsal; the spines strong, the longest nearly half head; pectorals reaching

anal; ventrals not to vent; no trace of slit behind last gill. Head 2½; depth 5½. D. IX-15; A. 14; V. I, 3. Atlantic coast; rather common northward.

(Mitch. Trans. Lit. and Phil. Soc. N. Y. i, 380, 1815; Günther, ii, 163: Acanthocottus virginianus Storer, Hist. Fish. Mass. 28.)

# 1073. C. æneus Mitchill.—Grubby.

Grayish olive, much variegated with darker; no distinct paler spots; back and sides with broad, dark, irregular bars; all the fins barred; mandible mottled; belly pale. Head rather broad; maxillary  $2\frac{1}{3}$  in head, reaching to just beyond pupil; supraocular and occipital ridges prominent, each with a low, bluntish spine; nasal spines moderate; upper preopercular spine shorter than eye, nearly twice length of the next spine, about reaching middle of opercle. Lateral line complete; sides with scattered concealed plates. Dorsal spines rather low, higher than the soft rays; pectorals reaching anal; no trace of slit behind last gall. Head  $2\frac{3}{4}$ ; depth 4. D. IX-13; A. 10; V. I, 3. L. 6 inches. Coast of Southern New England and New York; our smallest species; common in seaweeds near shore.

(Mitchill, Trans. Lit. and Phil. Soc. N. Y. i, 1815, 380; Goode & Bean, Bull. Essex Inst. 1879, 13: Cottus mitchilli Günther, ii, 164.)

# 1071. C. scorpioides Fabricius.

Very dark, finely mottled with paler; fins dusky, with paler spots; anal and ventral fins with the pale spots larger. Body stoutish, tail slender. Head very short; jaws short, the maxillary reaching the middle of the large eye; top of head concave between the two occipital ridges; preopercular spines quite short; opercular spine almost obsolete. Skin nearly smooth. Isthmus narrow, the fold across it very narrow; no trace of slit or pore behind the last gill. Dorsal fins slightly joined, the spines slender; pectorals reaching vent. Head 3; depth  $4\frac{2}{3}$ . D. X-17; A. 12; V. I, 3. Arctic regions of America; Greenland to Siberia. (Fabr. Fanna Groenl. 157, 1780; Bean, Bull. U. S. Nat. Mus. xv, 122; Lütken Aft. Vidensk. Meddels. Kjöbenh. 1876, 12: Cottus pachypus Günther, ii, 161.)

### 1075. C. scorpius L.

Dark olivaceous, mottled with paler; fins dusky, with paler spots. General characters of the subspecies grænlandicus, from which it differs chiefly in the smaller size, the narrower interorbital space, which is  $\frac{\pi}{4}$  diameter of eye, and in the lower spinons dorsal, the highest spines being about one-eighth the length to base of caudal; pore behind last gill usually very small, but evident. Head  $2\frac{1}{2}$ ; depth  $4\frac{1}{4}$ . D. X-16; A. 14. Northern Europe and Arctic regions of America, south to Eastport, Me.

(L. Syst. Nat.; Günther, ii, 159; Bean, Bull. U. S. Nat. Mus. xv, 116.)

Subsp. greenlandicus (Cnv. & Val.) Bean.—Daddy Sculpin.

Dark brown above, with broad darker bars: below vellowish, the belly in the male with large pale spots; back and top of head with gravish blotches; fins brown and yellow, all of them spotted and barred. Head large. Mouth large: maxillary reaching posterior edge of orbit, 23 in head; the supraorbital and occipital spines tubercle-like: a small tubercular spine on front of occipital ridge; upper preopercular spine reaching middle of opercular spine, its length equal to eye, not twice that of the spine below it; nasal spines sharp. Sides of body above lateral line with a series of imbedded prickly plates, below which are numerous scattered spines and prickles. Dorsal and anal fins high; spinous and soft dorsals about equal in height, their height more than one-seventh of length of body; ventrals long; pectorals about reaching vent. Eve large, equal to least interorbital width (in specimens a foot long). Head 23; depth 43. D. X-17; A. 14; V. I. 3; P. 18. L. 25 inches. New York to Greenland, common; one of the largest sculpins.

(Cottus grænlandicus Cuv. & Val. iv, 156; Acanthocottus variabilis Girard, Bost. Journ. Nat. Hist. vi, 248; Cottus grænlandicus Günther, ii, 161; Goode & Bean, Bull. Essex Inst. xi, 13, 1879; Acanthocottus variabilis Storer, Hist. Fish. Mass. 26; Day. Fish. Gt. Brit. 1880, 51; ? Cottus porosus C. & V. viii, 498; Acanthocottus mucosus Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 12.)

# 1076. C. polyacanthocephalus Pallas.

Dark olive above, much variegated with darker and reddish; belly mostly whitish; sides and belly (in males) with numerous blackish reticulations surrounding large round white spots; jaws dusky, mottled with whitish; membrane joining maxillary to preorbital black, with round white spots; fins, all but the ventrals, mottled and barred with blackish and vellowish. Body rather clongate. Head long and narrow, somewhat compressed, concave between the orbits, the orbital rim being elevated; nasal spines strong; a strong ridge above eye, with a blunt compressed spine behind it; behind this a small digitate cluster of ridges ending in low spines; behind these an irregular broken ridge on each side of the vertex, extending to the occiput; outside of this another ragged ridge; suborbital stay strong, striate; upper preopercular spine long, straight, simple, striate at base, longer than eye; a similar but shorter spine below it, not half as long, and the usual downward-directed spine at lower edge of preopercle and subopercle; , opercular spine moderate. Mouth rather large, the maxillary reaching beyond eye, half length of head; skin of top of head covered with small smooth warts; skin of body with some scattered rough tubercles, usually nearly smooth. Dorsals not very high; dorsal spines slender; pectorals reaching anal; ventrals moderate, I, 3. A minute pore usually present behind last gill. Lateral line complete. Head 2\frac{1}{4}; depth 4\frac{1}{4}. D. X-I, 13; A. 11. L. 24 inches. Puget Sound to Alaska; very abundant; one of the largest sculpins.

(Pallas, Zoogr. Ross,-Asiat. 1811, iii, 133; Günther, ii, 166.)

# 1677. C. labradoricus (Grd.) Gthr.

Nasal spines small; a rough prominence above orbit, and two similar ones on occiput; a slight depression on crown; four preopercular spines, the upper about  $\frac{2}{3}$  length of eye, equal to interorbital width; eye as long as snout, 5 in head, half length of maxillary, which extends to the vertical from its hinder margin. Dorsal spines slender, the longest  $\frac{5}{6}$  length of maxillary; pectorals reaching a little beyond anal; ventrals not to vent; skin above lateral line with a few spinous tubercles; a small slit behind fourth gill. D. X-14; A. 14; V. I, 3; P. 17; C. 11; B. 6. (Bean.) Labrador and Hudson's Bay.

(Acanthocottus labradoricus Grd. Bost. Journ. Nat. Hist. vi, 1870, 247, pl.; Günther, ii, 163; Bean, Proc. U. S. Nat. Mus. iv, 1881, 128.)

# 1078. C. tæmiopterus\* Kner.

Color of C. grænlandicus, but darker, with dark bars; gill-membranes and hinder part of belly dark; dark regions, with very bright white specks of different sizes; first dorsal partly black, partly transparent; second dorsal crossed by 3 oblique dark bands; anal by 4, in contrary directions; caudal with 3 dark bars; pectoral with 4 or 5 dark bars, much narrower than the interspaces; ventrals with black and white spots. Lower jaw projecting. Eye 5 in head, as long as snort; supraocular ridge slightly elevated, continued backward as a low bony ridge, without spines; a quadrangular depression between these ridges; crown and occiput with naked warty skin; preopercle with 4 spines, the uppermost straight, as long as eye; highest dorsal spine half length of head; soft dorsal twice as high; pectorals reaching anal; ventrals to vent. Sides often with irregular rough bony tubercles; a moderate slit behind last gill; gill-membranes partly free from isthmus. D. VIII-13; A. 12; Lat. l. 40. (Kner.) Alaska to Northern China..

(Cottus taniopterus Kner. Sitzungsber, Kais, Acad, Wiss, Wien, 1868, 310; Bean, Proc. U. S. Nat. Mus. 1881, 248.)

### 1079. C. quadricornis\* L.

Olivaceons, somewhat variegated; the fins faintly spotted. Body

<sup>\*</sup> Oncocoitus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 13: type Cottus quadricornis Gill. (ογκος, hook; κόττος, Cottus.)

rather slender. Head long, tapering forward; mouth large, the maxillary reaching to below posterior margin of eye; eye moderate, 4 in head; bones of head below eye cavernous, as in *Triglopsis thompsoni*, but less so; preoperele with 2 long, diverging spines, the upper and longer not quite reaching opercular margin; opercular and scapular spines quite short; a rugose spine, sometimes broader and expanded at tip like a cock's comb, above each eye posteriorly, and a similar one on each side of occiput. Males with irregular series of round, rough, wartlike scales above the lateral line; these wanting in the female; lateral line chain-like, with small imbedded plates; head naked. Frst dorsal convex, of slender spines, well separated from second, which is rather high, the longest ray 13 in head; pectorals reaching anal; ventrals moderate. A moderate slit behind last gill. D. VIII-14; A. 13; cœca 7; vert. 40; Lat. l. 45. Greenland to the Baltic Sea.

(Cottus quadricornis L. Syst. Nat.: Cottus quadricornis Günther, ii, 166: Oncocottus quadricornis Gill: Cottus hexacornis Rich. Franklin's Journ. 726: Cottus hexacornis Günther, ii, 166; Day, Fish. Gt. Brit. 1880, 53.)

#### 1080. C. humilis Bean.

Brownish, pale below; sides with a few white blotches; first dorsal with 2 broad oblique dark bands, separated by a pale area; second dorsal with 5 dark bands; anal with 6; pectorals with 4; candal with 3; ventrals pale, with 2 dark areas. Head broad, subtriangular, much depressed, its greatest depth 22 in its length; eye 2 in snout, 7 in head. equal to the concave interorbital space; surface of head covered with small dermal tubercles; patch of vomerine teeth very large; nasal spines strong; a blunt prominence above each eye, and 2 on the occiput; several radiating ridges behind eye, as in C. polyacanthocephalus; upper preopercular spine as long as eye; maxillary reaching slightly past eye,  $2\frac{1}{3}$  in head. Longest dorsal spine about half postorbital part of head; pectorals reaching soft dorsal. A series of rough bony tubercles above lateral line and some small ones below it. A pore behind last D. X-16; A. 13; V. I, 3; P. 18; B. 6. Head 23; depth 51. Chamisso Island, near Bering's Straits. (Bean.)

(Bean, Proc. U. S. Nat. Mns. iv, 149, 1881.)

### 1081. C. jaok Cuv. & Val.

Body and pectoral fins spotted with brown; vertical fins with brown bands. Resembles *C. scorpius*; the preopercular spines similar, but there are slight granulations instead of tubercles behind the eye and

Bull. Nat. Mus. No. 16—45

temples; rough scale-like tubercles along the back above the lateral line; first dorsal low. D. VII-15; A. 15. L. 21 inches. Bering's Sea. (Cuv. & Val.)

(Myoxocephalus Steller MSS. in Tiles. Mém. Acad. Sci. Petersb. iv, 273, 1811 (non-binomial); Cuv. & Val. iv, 172; Günther, ii, 165.)

# 1082. C. axillaris (Gill) Bean.

Bluish, with whitish spots on trunk and a darker band-like spot below anterior portion of second dorsal; abdomen yellowish; region above anal spotted; above this are larger spots confluent with the dark color of sides; spinous dorsal with 2 vertical dark bands; second dorsal with 3 oblique ones; candal banded; anal spotted; pectoral black at base, with 2 oblique bands; a dark spot on lower axil. Head subrhomboidal, large, depressed; postorbital crests little developed; preopercle with 2 simple spines near the angle, and 2 tubercles below; opercle with a longitudinal rib ending in a spine. Skin smooth, or with scattered tubercles. Gill-membranes forming a fold across the isthmus. D. IX-15; V. I, 3; B. 6. Bering's Strait. (Gill.)

(Boreocottus axillaris Gill, Proc. U. S. Nat. Mus. 1859, 166.)

# 1083. C. (?) polaris Sabine.

Pale, with clusters of minute dark spots. Head compressed; nasal spines present; lower jaw included; preoperele with 4 strong spines; pectoral fins larger than in *Uranidea gobio*; lateral line with a series of small tubercles. D. VI to VIII-13; P. 15; V. I, 4; A. 14; C. 14. L. 2 inches. North Georgia, British America. (*Storer.*) Probably not a *Cottus*.

(Sabine, Parry's First Voyage, 213; Storer, Synop, Fish. N. A. 307.)

# 1084. C. (?) platycephalus Pallas.

Olivaceous, much variegated, white below; fins spotted. Head large, much depressed, as broad as the body; lower jaw projecting; teeth on vomer and on palatines (?) ("in area lunata palatio medii, et utrinque lineari"). Eyes moderate, near together; vertex flat behind the eyes, with a ridge on each side, in front of which near the orbit, and behind at the nape, are oblong tubercles, each ending in a short spine; preopercle with 2 very strong, diverging spines above; opercle with a concealed spine; lateral line with concealed, elongate plates; back with rough warts; pectorals large; dorsal spines feeble. D. VII-12; A. 11; C. 10; P. 15; V. I, 3. L. 12 inches. Kamtschatka. (Pallas.) If this

species really has palatine teeth, it cannot belong to this genus. It may be a species of *Centridermichthys*.

(Pallas, Zoogr. Rosso-Asiat. iii, 135, 1811; Cuv. & Val. iv, 177; Megalocottus platycephalus Gill, 1861, 166.)

and. Head with tentacles above; lateral line without plates. (Porocottus\* (ill.)

### 1085. C. verrucosus Bean.

Very dark brown, whitish below: spinous dorsal dark, with a median and a posterior light band; soft dorsal and pectorals each with 5 dark bands; anal whitish, with a dark stripe; ventrals pale. Nasal spines sharp; a short tentacle above each eye and one on each side of the vertex; vertex and interorbital space deeply concave; crown, nape, and interorbital region with small dermal warts; upper preopercular spine as long as short diameter of eye; eye 4 in head, as long as snout; maxillary reaching to below middle of eye, half length of head, longer than fourth dorsal spine. Pectoral reaching front of anal; skin smooth; lateral line with numerous short vertical accessory branches, placed opposite each other. No pore behind last gill. Head 2½; depth 4½. D. XI-16; A. 15; V. I, 3; P. 17; C. 12; B. 6. L. 3½ inches. Plover Bay, near Bering's Straits. (Bean.)

(Bean, Proc. U. S. Na<sup>4</sup>, Mus. iv, 152, 1881.)

### 1086. C. niger Bean.

Almost black; sides mottled with lighter brown, sometimes with round white blotches on belly and sides; pectoral plain or with white blotches. Nasal spines blunt, covered with skin; no spines above orbits or on occiput; no sharp spines on head except the two upper preopercular spines, which are almost concealed; the uppermost as long as eye, 6 in head, and equal to shout or interorbital space; top of head with fine dermal granulations, the vertex with numerous slender tentacles; a soft tentacle of moderate length above eye; jaws equal; maxillary longer than fourth dorsal spine, 2 in head, reaching hinder margin of orbit. Caudal and ventrals each half length of head; pectoral not reaching vent; skin smooth. A small slit behind last gill. Head 2½. D. 1X–16; A. 12; V. I, 3; P. 16; B. 6. Saint Paul Island, Bering's Sea. (Bean.)

(Bean, Proc. U. S. Nat. Mus. iv, 151, 1881.).

### 1087. C. quadrifilis (Gill) J. & G.

Purplish, irregularly spotted with black; a dark spot below eye, and another on maxillary; fins mostly variegated with black; a dark spot

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1859, 166: type Porocottus quadrifilis Gill. (πορος pore; κοττός, Cottus.)

on upper axil, and another toward middle of base of pectoral. Head large, depressed, subrhomboidal; preopercle with a single hooked spine; opercle without longitudinal rib or spine; lower jaw and other parts of head with numerous large pores. Mouth moderate. Ventrals small. Skin naked; a slender filament over each eye, and one on each side of nape. Gill-membranes forming a fold across the isthmus. D. VIII-13; V. I, 3; B. 5. Bering's Straits. (Gill.)

(Porocottus quadrifilis Gill, Proc. U. S. Nat. Mus. 1859, 166.)

### 368.-GYMNACANTHUS Swainson.

(Phobetor Kröver.)

(Gymnocanthus Swainson, Class. Fish. &c., 1839, 271: type Cottus ventralis C. & V.)

General characters and appearance of *Cottus*, but with no teeth on the vomer, and with a small but well-defined slit behind the last gill. The upper preopercular spine is armed with 2 or 3 anther-like processes, and the fins are all very large, the ventrals notably so. Marine species of the Arctic Seas. ( $\gamma \nu \rho \nu \delta z$ , naked;  $\alpha z \delta \nu \theta a$ , spine.)

# 1088. G. pistilliger (Pallas) Gill.

Dark brown above, with traces of darker vertical bars; belly pale: males with the axillary region dusky, with many large round white spots; first dorsal blackish, with pale blotches; second dorsal with alternating oblique bands of white and blackish; anal and caudal nearly plain; pectorals and ventrals yellowish, with black cross-bars; mandible barred with black. Nasal spines small; occipital ridges low, the space between them concave, with rough plates; supraorbital ridge ending in a blunt tubercle; interorbital area with smooth skin. Eyes very large; maxillary extending to pupil; upper preopercular spine broad, much shorter than eye, with about three points; skin mostly smooth; axil prickly; inner edge of middle pectoral rays papillose (2). Spinous dorsal very high and long, the longest spines in the male three-fourths length of head; second dorsal a little lower; anal very long, rather low; pectorals very broad, reaching past front of anal, the lower rays rapidly shortened; ventrals extremely long, the rays long-exserted, reaching past front of anal; anal papilla large. Head  $3\frac{1}{3}$ ; depth  $4\frac{2}{3}$ . D. XII-16; A. 18; V. I, 3; P. 16; vert. 12 + 18. Arctic Seas, south to Norway, Alaska, and Labrador.

(Cottus pistilliger Pallas, in Cuv. & Val. iv. 193, 1829: Cottus ventralis Cuv. & Val. iv. 194: Cottus pistilliger Pallas, Zoogr. Ross.-Asiat. iii, 43, printed 1811, published 1831: Acauthocottus patris H. R. Storer, Bost. Journ. Nat. Hist. vi, 250: Cottus ventralis Günther, ii, 167: Cottus pistilliger Günther, ii, 167: Cottus tricuspis Reinh. Vidensk.

Selsk, Nat. Math. v, iii: Cottus fabricii Girard, Monogr. Cott. 59: Cottus tricuspis Günther, ii, 168; Phobetor tricuspis Kröyer, Natur. Tidskr. i, 263, 1844; Bean, Bull. U. S. Nat. Mus. xv, 127, 1879; Cottus ventralis Collett, Christiania Vid. Selsk. Forh. 1878, 151.)

### 1089. G. galeatus Bean.

Olivaceous; back with four distinct brown spots, the longest nearly twice as long as eye, and extending a little below lateral line, there blending with a wavy lateral stripe; dorsals and pectorals with interrupted black bands; lower fins plain whitish. Body elongate. A small tubercle above each eye; four preopercular spines, the longest about as long as eye, and with two or three processes. Space between eyes deeply concave, completely covered with bony granulations, as are the crown and neek; similar granulations on hinder margin of orbit, on suborbital stay and on opercles. Skin of body naked. Pectorals, and in males the ventrals also, reaching beyond vent; maxillary reaching to below eye. Head  $3_4^3$  (including caudal); depth  $7_2^1$ . D. XI-16; A. 19; V. I, 3. Unalashka. (Bean.)

(Bean, Proc. U. S. Nat. Mus. 1881, 153.)

### 369.—TRIGLOPSIS Girard.

(Ptyonotus Gthr.)

(Girard, Proc. Bost. Soc. Nat. Hist. iv, 18, 1851: type Triglopsis thompsoni Grd.)

Body and head slender. Skin naked; lateral line chain-like. Teeth on vomer, none on the palatines. Eyes large, the interorbital area concave; bones of lower part of head extensively eavernous; a small but distinct slit behind last gill; gill-membranes almost free from the isthmus, forming a broad fold across it; preopercular spines straight, simple; fins large. Fresh-water fishes, closely related to *Cottus*, to which genus the single known species should, perhaps, be referred. Its relations with the group called *Oncocottus* are certainly intimate.  $(\tau \rho i \gamma \lambda a, Triyla; \delta \psi \ell_{\xi}, \text{ appearance.})$ 

# 1090. T. Hompsoni Grd.

Pale olivaceous, with darker blotches; upper fins faintly banded. Body clongate, very slender. Head long, depressed above; snout long and pointed; eye quite large, nearly as long as snout, much wider than interorbital space, 4 in head; jaws subequal; mouth large, the maxillary extending rather beyond middle of eye; preopercle with 4 sharp spines, the upper much shorter than pupil; cavernous structure of skull highly developed; upper surface of head smooth; gill-mem-

branes not broadly united, nearly free from isthmus. Dorsal fins well separated; spinous dorsal short and low, its height little more than length of snout; second dorsal very large, 3 times height of first, its longest rays about as long as head; anal high, half as high as second dorsal; pectoral long, reaching past front of anal; ventrals well developed; lateral line chain-like, conspicuous; skin perfectly smooth. Head 3; depth 6. D. VII-18; A. 15; V. I, 3. L. 3 inches. Deep waters of the Great Lakes.

(Girard, Proc. Bost. Soc. Nat. Hist. iv, 19, 1851; Girard, Monogr. Cott. 65: *Ptyonotus thompsoni* Günther, ii, 175, the name *Triglopsis* being set aside on account of the prior *Triglops.*)

#### 370.-ENOPHRYS Swainson.

(Aspicottus Grd.: Clypeocottus Avres: Ceratocottus Gill.)

(Swainson, Class. Fish. &c. 1839, 271: type Cottus claviger C. & V.)

Body short and thick, depressed anteriorly. Head very large, mailed above with rugose, bony plates; a series of large, rough, bony plates along lateral line; no scales. Teeth in villiform bands in jaws and on vomer, none on palatines; preopercle with strong, straight spines; suborbital stay broad, externally bony; gill-membranes joined to the isthmus, not forming a fold across it; a slit behind fourth gill. Dorsal fins separate, the anterior short, not notched; anal short. Intestinal canal elongate. Herbivorous, feeding chiefly on algæ. ( $\varepsilon\nu$ , on;  $\nu\varphi\rho\nu\varepsilon$ , eyebrow.)

### 1091. E. bison (Grd.) J. & G .- Stone Sculpin.

Olivaceous above, variegated with blackish and reddish, yellowish below; fins olivaceous, marked with black; ventrals pale. Snout blunt; maxillary reaching beyond pupil; external bones of head rough granular; interorbital space elevated and concave, the orbital ridge without spine; suborbital stay covering most of cheek; a ridge extending backwards from each eye, the two connected by a cross ridge at occiput; the ridges are large and rough, and the space between them is concave; preopercle with 4 spines, the upper very long, straight and rough, usually reaching past opercle, a little more than one-third head; opercular ridge very broad; subopercle with 2 diverging spines; a single series of large, rough, granular plates along sides, from opercle to base of candal, the plates without keel or spine and growing smaller behind; spinous dorsal small, much lower than soft rays; anal short. Head 2½; depth 4. D. VIII-12; A. 9. L. 12 inches. San Francisco to Alaska;

abundant. Resembles Cottus bubalis, with which it has been improperly confounded by Dr. Günther.

(Aspicottus bison Girard, Proc. Acad. Nat. Sci. Phila. 1854, 130: Chypcocottus robustus Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 12: Aspicottus bison Girard, U. S. Pac. R. R. Surv. 65.)

### 1092. E. diceraus (Pallas) J. & G.

Greenish and reddish, marbled and spotted. Form of *E. bison*, the head large, wider than deep or long; top of head nearly as in *E. bison*, the ridges higher and very rough; orbital ridges elevated, continued backward toward the nape, the occipital ridges sharp behind; upper preopercular spine very long, rough, nearly two-thirds as long as head, with strong recurved hooks or serrations on the upper edge; lower preopercular spines strong; opercle with a longitudinal rib and no distinct spine; lateral line with a row of rough bony scutella, each with a minute central spine; skin above more or less villous or prickly, elsewhere smooth. Isthmas wide; a slit behind last gill; vomer with teeth. D. VII-14; A. 10; C. 12; P. 17; V. I, 3. L. 6 inches. Alaska and Kamtschatka. (Here described from a specimen in the British Museum.)

(Cottus diceraus Pallas, Nov. Act. Petrop. 1783, 354: Cottus diceraus Cuv. & Val. iv, 189: Synanceia cervus Tiles. Mém. Ac. St. Petersb. iii, 278: Ceratocottus diceraus Gill, Proc. Acad. Nat. Sci. Phila. 1859, 165, and 1861, 167: Cottus diceraus Giinther, ii, 189.)

# 1093. E. claviger (Cuv. & Val.) Sw.

Dark brown, with 3 or 4 vertical bands; belly white. Top of head everywhere rough; two strong nasal spines; superciliary margins much elevated, with a deep groove between them; 4 preopercular spines, the upper exceedingly long and strong, extending nearly to the vertical from the end of the first dorsal, serrated and coarsely toothed on its upper margin, but without antier-like processes; "occiput with a very long cuneiform process on each side"; lateral line with bony plates, rougher than in E. bison, each with a serrated keel and spine; skin subvillous above, with small rough warts; a series of small extaneous appendages above the anal. Suborbital stay spinous; vomerine teeth present; isthmus broad; slit behind last gill large. D. VI-13; A. 11; V. I, 3. L.  $2\frac{1}{2}$  inches. Bering's Sea. (Here described from the original type, in the British Museum.)

(Cottus claviger Cuv. & Val. iv, 195, 1829; Cottus claviger Günther, ii, 167.)

#### 371.—LIOCOTTUS Girard.

 $(\textit{Leiocottus}\ Girard, Proc.\ Acad.\ Nat.\ Sci.\ Phila, 1856, 133:\ type\ \textit{Leiocottus}\ kirundo\ Girard.)$ 

Body elongate, covered with thick, smooth skin. Head compressed, narrowed above, not externally bony. Mouth small, horizontal, low; villi-

form teeth in both jaws and on the vomer, none on the palatines; upper preopercular spine short, strong, with bifurcated tip; suborbital stay narrow; gill-membranes partly free from the isthmus, over which they form a broad fold; a slit behind fourth gill. First dorsal with its upper margin somewhat S-shaped, the first two spines elongate, the middle ones of nearly equal length, and the posterior ones rapidly shortened; ventrals I, 3. Pacific. ( $\lambda \varepsilon I \sigma \varepsilon$ , smooth;  $z \delta \tau \tau \sigma \varepsilon$ , Cottus.)

### 1094. L. Inimanndo Grd.

Olivaceous, shaded with light blue, and reticulated with brownishred, the latter color predominating on the head; sides with four broad. oblique, brownish-red bars, the first three running from dorsal forwards and downwards, the fourth from caudal peduncle backwards to base of caudal; abdomen orange brown, with pale spots; caudal orange brown, with yellow bars near the tip; fins with bars and spots of dark brownish-red; breast and ventrals whitish; three dark blotches at base of pectorals; spinous dorsal with oblique dark streaks; a dark blotch on each eye above, and a light streak forwards and downwards from eye. Body elongate, fusiform, the caudal peduncle slender; profile of snout decurved; maxillary reaching front of orbit; three small cirri at the end of each maxillary; preopercular margin with several similar cirri; opercle and shoulder-girdle without spines; upper preopercular spine as long as pupil. Top of head smooth; supraorbital ridges little elevated; nasal spines distant from tip of snout. Spinous dorsal elevated in front, the first two rays much longer than the others, nearly two-thirds length of head; soft dorsal and anal fins rather long; pectorals reaching past front of anal; ventrals to vent. Head 31; depth 41; eye large, 41 in head. D. IX-17; A. 15; V. I, 3. L. 10 inches. Santa Barbara Islands; extremely local.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 133; Girard, U. S. Pac. R. R. Surv. Fish. 62: Cottus birundo Günther, ii, 166.)

#### 372.—TRIGLOPS Reinhardt.

(Reinhardt, Vid. Selsk. Natur. Math. Afh. v, lii: type Triglops pingeli Reinhardt.)

Body rather elongate, the tail very slender. Head small and compressed. Month moderate; villiform teeth on jaws and vomer, none on the palatines; preopercular spines small, simple. Head prickly, but without scales. A row of enlarged plate-like scales along the lateral line; a similar row above it at the base of the dorsal fin; the space between these densely prickly; lower half of body crossed at short intervals by transverse undulating folds of skin, the edge of the fold with

minute rough scales, causing it to appear sharply and finely serrate. Gill-membranes united, free from the isthmus; a distinct slit behind last gill. Dorsal spines rather high and slender; ventrals apparently I, 3. Arctic seas.  $(\tau \rho_1 \gamma \lambda a, \text{Trigla}; \check{\omega} \varphi, \text{appearance.})$ 

## 1095. T. pingeli Reinh.

Olivaceous, somewhat variegated with darker; fins barred; a series of dusky spots along sides; an occilated black spot on posterior part of spinous dorsal. Head very slender; eye large, placed high, but lateral; preopercular spines short; maxillary extending to below middle of orbit; nasal spines sharp. Ventral fins rather short; pectorals extending to front of anal; tail very slender, its diameter less than the eye; anal papilla large. Head  $3\frac{1}{2}$ . D. 1X-21; A. 21. Alaska to Greenland and Cape Cod.

(Reinhardt, Vid. Selsk, Natur, v, lii; Günther, ii, 173: Triglops pleurostictus Cope, Proc. Acad. Nat. Sci. Phil. 1865.)

# 373.—LEPTOCOTTUS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 130: type Leptocottus armatus Grd.)

Body elongate, depressed, covered with perfectly smooth skin. Head depressed, oblong, not very broad, without cirri; lower jaw included; suborbital stay narrow; teeth on jaws, vomer, and palatines. Gill-membranes rather narrowly joined to the isthmus, not forming a fold across it; a slit behind fourth gill; preopercular spine strong, with two or three points hooked upwards. Dorsal fins separate; the spinous dorsal short and small, entire; ventrals I, 4. Pacific coast. (λεπτος, slender; χοττος, Cottus.)

# 1096. L. armatus Grd.

Grayish olive above, becoming abruptly white and silvery below; sides creamy; pectoral fins creamy yellow, with five or six black crossbars; spinous dorsal dusky, with an ink-like blotch on tip of last rays, and an oblique white band below; soft dorsal dusky, with several oblique white bands; candal banded; ventrals and anal plain. Head long and depressed; mouth large, the maxillary reaching beyond eye; interorbital space broad, scarcely concave; nasal spines concealed; top of head flattish, covered with rugose skin; upper preopercular spine with three or four spinules hooked upwards; suborbital stay slender, not reaching preopercle; eye very small, less than interocular width,  $7\frac{1}{2}$  in head; lateral line complete; skin everywhere smooth; no prickles nor cirri. Dorsal spines very slender and low; pectorals reaching

vent; ventrals half way to vent. Head 3 in length; depth 6. D. VII-17; A. 17; V. I, 4. L. 12 inches. Kodiak to San Diego; everywhere very common; the most abundant of the Cottoids of our west coast.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 131; Girard, U. S. Pac. R. R. Surv. Fish. 60: Centridermichthys armatus Günther, ii, 171.)

### 374 .- HEMILEPIDOTUS Cuvier.

(Temnistia Richardson: Calucilepidotus Ayres.)

(Cuvier, Règne Anim, ed. 2d. 1829: type Cottus hemilepidotus Tilesius.)

Body with two broad bands of rough scale-like plates on each side, one along the side of the back, one along the lateral line, the upper bands meeting anteriorly in front of dorsal; scales roundish, their upper and posterior margins free; skin otherwise naked; head naked. Villiform teeth on jaws, vomer, and palatines. Branchiostegals 6. A small slit behind fourth gill; gill membranes joined to the isthmus, sometimes forming a narrow fold across it; preopercular spines simple, strong. Dorsal fins connected, the first long, with strong spines, emarginate, the first three spines shorter than those which follow; ventrals I, 4. North Pacific. ( $\hat{\gamma}\mu\iota$ , half;  $\lambda \varepsilon \pi \iota \delta \sigma \tau \sigma \varepsilon$ , scaled.)

a. Belly immaculate.

# 1097. II. spinosus (Ayres) Grd.—Cabezon.

Brown, mottled and obscurely barred, often tinged with red; top of head usually with brick-red; fins all, except ventrals, mottled with blackish and reddish; skin joining bones of jaws unspotted; belly whitish, immaculate. Body rather elongate, depressed; head broad, somewhat concave between the occipital ridges; two sharp radiating ridges behind upper posterior margin of each orbit; top of head covered with loose skin, and with thick-set mucous tubes; interorbital space narrow, concave, half diameter of eye; preopercle with 2 strong, shortish, diverging spines above; fleshy slips above opercle, near upper posterior part of eye, and at occiput; a long fleshy slip on maxillary, and 4 on lower jaw; many scales on sides with small flaps; skin, where not scaly, thin and lax; dorsal band of scales with about 7 rows at its widest part, anteriorly much wider than the space between it and the lateral band; isthmus rather narrow, the membranes not forming a fold across it; dorsal fins considerably connected, spines very low, the highest about two-thirds the height of the soft rays, and  $3\frac{3}{4}$  in head; first dorsal spine about half as long as maxillary; pectorals

broad, shortish, about reaching vent; distance from spinous dorsal to snout greater than length of pectoral. Head 3; depth 5. D. III, VIII, 20; A. 16; V. I, 4; Lat. l. 60. L. 10 inches. Coast of California, in rather deep water; seen by us only about Monterey and San Francisco.

(Calycilepidotus spinosus Ayres, Proc. Cal. Acad. Nat. Sci. i, 76, 1855; Girard, Proc. Acad. Nat. Sci. Phila. 1856, 134; Girard, U. S. Pac. R. R. Surv. Fish. 68.)

# 1098. H. jordani Bean.

Throat and belly pure white; upper parts brownish, with wavy darker bars. Dorsal band of scales with but 4 rows in its widest part. Eye as long as snout, 4 in head, the short diameter equal to interorbital space; maxillary extending to below middle of eye; top of head corrugated; distance of spinous dorsal from snout equal to length of pectoral; first dorsal spine as long as maxillary; longest dorsal spine  $2\frac{1}{2}$  in head; pectoral reaching anal; ventral nearly or quite to vent; a narrow fold of skin across isthmus. Head  $2\frac{2}{3}$ ; depth  $4\frac{1}{2}$ . D. III, VIII, 21; A. 17; V. I, 4. L. 13 inches. Unalashka.

(Bean, Proc. U. S. Nat. Mus. 1881, 153.)

aa. Belly covered with small black spots.

### 1099. II. trachurus (Pallas) Günther.

Olivaceous or reddish, more or less mottled and barred with darker; belly and lower parts pale, profusely covered with small blackish spots; fins all more or less speckled; skin joining bones of jaws finely spotted with black. Body robust, not depressed. Head large; interorbital space deeply concave, its width \(^2\) diameter of the large eye; occipital ridges low and broad; bones of top of head extremely rough, naked; with radiating striæ, but without spines; small flaps over posterior part of eye, at occiput, over opercle, and on cheek, maxillary, preorbital, mandible, and tip of snout. Skin thick and firm; gill-membranes forming a slight fold across the isthmus; upper band of scales of about 4 rows, narrower anteriorly than the interspace; first three spines of dorsal about equal, lower than those following; soft dorsal high. Head 2\(^3\); depth 3\(^1\). D. III, VIII, 19; A. 15; V. I, 4; Lat. l. 61. L. 18 inches. Alaska to San Francisco; abundant in Puget Sound; a much larger fish than *II. spinosus*, and readily distinguished by the spotted belly.

(Cottus hemilepidotus Tiles, Mém. Ac. Petersb. iii, 262, 1801; Cottus trachurus Pallas, Zoogr. Ross-Asiat. iii, 138, 1811; Hemilepidotus tilesii Cuv. & Val. iv, 276, 1829; Günther, ii, 173; Blepsias ventricosus Eschscholtz, Zoöl, Atlas, 3d Heft, 14, t. 13; Temnistia ventricosa Richardson, Fauna Bor.-Amer. Fish. 1836, 59; Hemilepidotus gibbsi Gill, Proc. Acad. Nat. Sci. Phila. 1862, 13.)

#### 375 .- MELLETES Bean.

(Bean, Proc. U. S. Nat. Mus. 1879, 354: type Melletes papilio Bean.)

Body moderately elongate. Head broad, depressed, rounded in front, naked, with several cutaneous flaps; jaws, vomer, and palatines with bands of villiform teeth; preopercular spines simple, rather strong; gill membranes broadly connected, free from the isthmus; a slit behind the last gill; a narrow band of etenoid scales along sides of back, meeting in front of dorsal; a few prickles on anterior parts of body, and some small dermal flaps on sides; skin otherwise naked; dorsals connected; the spinous dorsal long, not emarginate; pectorals well developed, the rays all simple; ventrals very long, I, 4, the inner surface of the rays armed with stiff setæ; pyloric cæca 6; no air-bladder. Alaska. ( $\mu\eta\lambda\lambda\eta\tau\eta\tau$ , a loiterer; remaining in shallow pools as the tide recedes.)

# 1100. M. papilio Bean.

Grayish brown, with darker bands and various mottlings; belly grayish, with round white spots; fins all much mottled and barred. Nasal spines obtuse; 2 spines above posterior part of orbits, and 2 on the vertex, the last four with short filaments. Ventrals 2 in length, longer than pectorals, extending to the seventh anal ray ( $\delta$ ). Head 4; depth  $2\frac{2}{3}$ . D. XII, 20; A. 17; P. 17; V. I, 4. L. 7 inches. Saint Paul's Island, Alaska.

(Bean, Proc. U. S. Nat. Mus. 1879, 354.)

#### 376.—SCORPENICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 131: type Hemitripterus marmoratus Ayres.)

Body rather robust, covered with smooth, thick skin. Head large, somewhat compressed, its upper surface rugose. Mouth rather large, with villiform teeth on jaws, vomer, and palatines; gill-membranes broadly united, free from the isthmus; a large slit behind fourth gill; preopercular spines small, simple; spinous dorsal long, scarcely emarginate, but slightly depressed near its middle, the first four spines shorter than those immediately following; ventral fins large, I, 5. Size large. Pacific Ocean. ( $\sigma zo\rho \pi a v a$ , Scorpana;  $\partial z \partial b z$ , fish.)

# 1101. S. marmoratus (Ayres) Grd.

Olive brown, thickly mottled with dark blotches and light spots, and reticulated with different shades of green and brown; sides with 5 irregular, dark, vertical blotches, of which two are under each dorsal and

extend on the fins: belly livid bluish or green, reticulated with olive: the ground color is exceedingly variable, ranging from cherryred to green; lips blotched with white; fins all more or less barred; flesh and membranes livid bluish. Top of head rugose, without spines: interorbital space concave, narrower than the large eye; a fleshy flap on middle of snout, and one on end of maxillary; superciliary cirri large, more than half diameter of orbit, laciniate; upper preopercular spine short, straight, about half diameter of eye; suborbital stay yery broad; maxillary extending to beyond eye. First four spines of dorsal subequal, shorter than the fifth: dorsal fins scarcely connected at base: pectorals shortish, not reaching anal. Skin thick and leathery, without prickles or cirri. Head 3; depth 4. Eye 6 in head. A. 12; P. 15; V. I, 5; Lat. l. (pores) 80; pyloric cœca about 30; vertebræ 15 + 21. L. 30 inches. Puget Sound to San Diego; very abundant. The largest of our Cottidae, reaching a weight of 10 to 15 pounds. (Hemitripterus marmoratus Ayres, Proc. Cal. Acad. Sci. 1854, 4; Girard, U. S. Pac. R. R. Surv. Fish. 64; Günther, ii, 154.)

277.—OLIGOCOTTUS Girard.

(Clinocottus and Blennicottus Gill.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 133: type Oligocottus maculosus Girard.)

Body rather elongate, the skin smooth or provided with some small prickly scales; preopereular spines short, simple or furcate; small tentacles on head and anterior parts of body; gill-membranes broadly united, free from the isthmus; a slit behind fourth gill; dorsal spines slender, the fin short and not emarginate; anal papilla large; ventrals I, 3, or I, 4. Small fishes of the North Pacific, inhabiting rock-pools between tide-marks. (δλιγος, small; zοττος, Cottus.)

a. Month with distinct lateral eleft; the head narrow anteriorly.
 b. Skin with imbedded, prickle-like scales. (Clinocottus Gill.\*)

# 1102. O. analis Grd.

Olivaceous, much mottled, and with numerous small black and white spots; about five irregular darker bars; a dark bar at base of caudal; fins all spotted; cirri very numerous, mostly whitish, giving the fish a woolly appearance in life. Head narrower anteriorly and rather pointed; mouth with lateral cleft, the maxillary reaching beyond pupil; band of palatine teeth short and narrow; eye large, 5 in head, about twice the width of the deeply-grooved interorbital space; nasal spines distant

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: type Oligocottus analis Grd. (Clinus; Cottus.)

from snout; preopercular spine short, bifurcate; cranium plane above. Upper part of body mesially, covered with minute, imbedded, non-imbricated, pectinate scales; anteriorly, small cirri, mostly bifid or trifid, take the place of the scales. Head, especially above, with very many similar cirri; a fringe of cirri on edge of preopercle. Dorsal fins contiguous, rather low; pectoral reaching past front of anal. Anal papilla very large. Head  $3\frac{1}{2}$ ; depth  $4\frac{1}{2}$ . D. IX-17; A. 14; V. I, 3; P. 16. L. 7 inches. Coast of California; abundant in rock-pools from Monterey southward to Lower California.

(Grd., Proc. Acad. Nat. Sci. Phila. 1857, 201; Girard, U. S. Pac. R. R. Surv. Fish. 57: Centridermichthys anatis Günther ii, 171: Cottus criniger Günther ii, 522.)

bb. Skin without scales or prickles. (Oligocottus.)

# 1103. O. maculosus Grd.—Johnny.

Usual color reddish brown, varying to gray, intense green or crimson according to surroundings, the vivid colors developed in the presence of similarly colored algae; fins all barred; belly usually livid bluish or greenish; lower side of head with white mottlings; northern specimens with an ocellated black spot on front of spinous dorsal. Head slender, narrowed above, the snout rather pointed; maxillary reaching pupil; top of head with several scattered cirri; a few on sides of head, none on edge of preopercle; cirri on lateral line anteriorly and on front of back, also on base of spinous dorsal. No scales or prickles anywhere; preopercular spine forked. Front rays of anal enlarged and partly detached in  $\delta$ ; anal papilla large (in  $\delta$ ); pectorals reaching well beyond front of anal. Head  $3\frac{a}{3}$ ; depth  $4\frac{1}{2}$ . D. VIII-16; A. 12. L. 3 inches. San Luis Obispo to Alaska, exceedingly abundant northward; one of the smallest of marine Cottidae.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 153; Girard, U. S. Pac. R. R. Surv. Fish. 56: Centridermichthys maculosus Günther, ii, 171.)

aa. Mouth with very little lateral eleft; the head globoid. (Blanicottus\* Gill.)

#### 1101. O. globiceps Grd.

Dark olive, with obscure darker cross-bars; first dorsal with 2 dark streaks above; fins generally barred with greenish, orange, or blue; cirri mostly black. Body little compressed; head extremely short and blunt, narrowed above, nearly everywhere convex. Mouth anterior, short and broad, almost without lateral cleft; lower jaw shortest; maxillary reaching past front of the small eye; interorbital space very nar-

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: type Oligocottus globiceps Grd. (Blennius; Cottus.)

row, grooved, about half width of eye; preopercular spine with a single point turned upwards; top of head with two series of cirri; none on sides of head, except a few on upper part of opercle; a series of cirri along anterior half of lateral line; skin without scales or prickles; pectorals reaching beyond front of anal. Head 3\frac{3}{4}; depth 4\frac{1}{4}. D. IX-16; A. 11; V. 1, 3. Northern specimens are larger in size, with paler and more variegated coloration and red markings; the dorsal has one or two more rays, the preopercular spine is stronger and slightly hooked upwards, and the opercle has many more cirri above than in the southern form. Pacific coast, from Monterey northward to Kodiak; in rockpools; rather rare.

(Girard, U. S. Pac. R. R. Surv. Fish. 1858, 58: Centridermichthys globiceps Günther, ii, 171.)

#### 378.-BLEPSIAS Cuvier.

(Peropus Bennett: Histiocottus Gill.)

(Cuvier, Règne Animal, 1829, ed. 2d: type Trachinus cirrhosus Pallas.)

Head and body compressed; skin hispid with stiffish villiform prickles, sometimes with definitely naked areas; snout and chin with several rather long barbels; mouth small; teeth villiform, on jaws, vomer, and palatines; preopercle with two short blunt spines; gill-membranes free from the isthmus; gills four, a slit behind the fourth; top of head with bony ridges; suborbital stay narrow; first dorsal short, elevated in front, the spines slender; second dorsal large; anal similar, lower; ventrals very short, I, 3; pectorals long. Pacific coast. (An old name of some fish; from  $\beta\lambda\varepsilon\pi\omega$ , to look.)

a. Spinous dorsal emarginate; sides with naked areas.

# 1105. B. cirrhosus (Pallas) Günther.

Dark olivaceous, sides of back with four to six vertically oblong black blotches edged with paler, not reaching nearly to lateral line; belly and naked areas on sides whitish; black bands radiating from eyes; fins dark, with large pale blotches and dark spots; caudal with light and dark bars; ventrals plain; a small white spot on front of spinous dorsal. Supraocular ridges well developed; interorbital space concave, with two low ridges extending backwards from nasal spines, diverging towards occipital ridges; the latter large, partly interrupted; suborbital stay conspicuous; temporal ridge present; maxillary reaching to beyond middle of pupil; snout with five barbels, chin with six, the longest about as long as the eye, which is 33 in head; a small cirrus

on each interorbital ridge; interorbital space as wide as eye; sides with three or four pale, well-defined, naked areas behind pectorals, the two anterior much the largest; behind these a long naked strip along the lateral line, colored like the rest of the body; first four spines of dorsal elevated,  $\frac{2}{3}$  to  $\frac{3}{4}$  length of head; the fifth much shortened; membrane deeply notched between the fifth spine and the sixth, which is longer than the one before it; ventrals as long as eye; pectorals reaching much beyond front of anal; first rays of soft dorsal short; the others gradually lengthened to near the last, the highest higher than the dorsal spines; caudal longer than head. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ . D. V, III-23; A. 20; P. 12; Lat. l. 50. L. 6 inches. North Pacific, south to San Francisco.

(Trachiuus cirrhosus Pallas, Zoogr Ross.-Asiat. iii, 237, 1811: Blepsias trilobus C. & V. iv, 375, 1829; Günther, ii, 153; Steindachner, Ichth. Beiträge, v, 128, 1876.)

aa. Spinous dorsal not emarginate; no naked areas.

## 1106. B. bilobus Cuy. & Val.

Olivaceous, paler below; dorsal region with 4-5 black bars, reaching one-third the distance to the lateral line, and somewhat continued on the fins; caudal with a black bar at base, otherwise plain; pectorals and anal blotched with black. Body shorter and deeper than in B. cirrhosus, with thicker caudal peduncle and heavier head, the bones less firm; snout short, obtuse; interorbital space very wide, concave, half wider than the small eye; short occipital ridges present, besides several bluntish tubercles. Mouth broad, oblique, the maxillary reaching pupil; teeth small, distant; barbels as in cirrhosus. Head and body covered with prickles, larger and blunter than in cirrhosus; no naked patches on body; fins less developed than in cirrhosus; first five or six spines of dorsal subequal, the last three abruptly shorter; pectorals longer and much broader than in cirrhosus, reaching seventh anal ray; caudal short, much shorter than head. D. IX-21; A. 18; P. Coasts of Alaska and Kamtschatka; the specimen here described from Kodiak.

(Cuv. & Val. iv, 379, 1829: Peropus bilobus Bennett, Beechey's Voy. Zoöl. Fish. 59; Günther, ii, 153.)

#### 379.—NAUTICHTHYS Girard.

(Girard, U. S. Pac. R. R. Surv. Fish. 1858, 74: type Blepsias oculofasciatus Girard.)

Body rather elongate, compressed, but not elevated, the skin evenly covered with short, close-set, villiform prickles. Head short, strongly

compressed, the cheeks subvertical; orbital ring much elevated above, with several blunt protuberances behind; nape much depressed, with the base of the dorsal fin rising abruptly above it; mouth small; teeth on jaws, vomer, and palatines; preopercle with small bluntish spines above; gill-membranes broadly united to the isthmus; a slit behind fourth gill; branchiostegals 6; first dorsal falcate, the spines very flexible, the anterior much clevated, much longer than head, the posterior rapidly shortened; second dorsal long and rather high; anal fin similar to second dorsal, but shorter and lower; pectorals moderate; ventrals I, 3, well developed, nearly as long as head. Pacific coast. Small fishes, of singular appearance. ( $\nu a \dot{\nu} \tau \gamma z$ , sailor;  $\dot{\nu} z \dot{\nu} \dot{\nu} z$ , fish; in allusion to the development of the first dorsal fin.)

# 1107. N. oculofasciatus Grd.

Grayish above; sides with dark marblings and obscure dusky bands; a very conspicuous black band through the eye and across cheeks; first dorsal blackish; other fins barred with light and dark; ventrals plain. Maxillary reaching to opposite pupil; eye very large, longer than snout; nasal spines conspicuous, curved; maxillary and edge of preopercle with minute cirri; orbit with a branched cirrus, as long as pupil; the narrow interorbital space deeply channelled; supraocular ridge posteriorly with 3 blunt tubercles; 2 compressed tubercles on each side of first dorsal; a deep pit at nape, extending under origin of first dorsal; spinous dorsal smooth; rays of soft dorsal and caudal roughened with prickles; dorsal spines nearly twice length of head; ventrals \(\frac{3}{4}\) length of head, a little shorter than caudal; pectorals long. Head \(\frac{3}{2}\); depth \(\frac{3}{4}\). D. IX-28; A. 19; P. 14; V. I, 3; Lat. l. 44. L. 6 inches. Pacific coast, San Francisco to Unalashka; chiefly northward.

(Blepsias oculofasciatas Girard, Proc. Acad. Nat. Sci. Phila. 1857, 202; Günther, ii, 157; Steindachner, Ichth. Beiträge, v, 130.)

## 380.—RHAMPHOCOTTUS Günther.

(Günther, Ann. Nat. Hist. xiv, 369, 1874: type Rhamphocottus richardsoni Günther.)

Body short, elevated. Head very large, its greatest depth greater than that of the body; skull with 2 strong bony ridges from above the front of the eye, continuous with 2 large occipital ridges, leaving the interorbital space and middle line of the top of the head strongly coneave; snout slender, narrow, and abruptly protruding; month very narrow,  $\mathbf{\Lambda}$ -shaped, its gape longer than wide; teeth villiform, none on the vomer or palatines; gill-opening confined to the region above the

Bull. Nat. Mus. No. 16—46

base of the pectorals, the membranes below completely united to the shoulder girdle and isthmus; apparently no slit behind last gill; a stout, straight, preopercular spine; nasal spines present; no other spines on head. Skin everywhere on head and body firm, immovable, densely covered with stiff bifid or trifid spinous prickles; spinous dorsal very small; pectoral with procurrent base. ( $\beta a \mu \psi \sigma \xi$ , snout;  $z \sigma \tau \tau \sigma \xi$ , Cottus.)

#### 1108. R. richardsoni Gthr.

Brownish, with 6 or 8 oblique black bands running downward and forward; a white bar below eye; a dusky bar at bases of pectorals and ventrals, the fins otherwise plain. Head hard and bony, nearly as long as rest of body; snout rather longer than eye, which is of moderate size, and with partly vertical range; maxillary extending to front of eye; suborbital stay strong; pectorals long, reaching tips of ventrals and past front of anal; ventrals long, their rays prickly. Head 2; depth 2. D. VII-14; A. 7 or 8; V. ca. I, 4. L.  $2\frac{1}{3}$  inches. Northern seas. Three specimens known: the one here described from Bering's Straits; the original, said to be from "Fort Rupert"; a third recently obtained by Mr. Lockington, from the stomach of a *Sebastodes*, at Monterey.

(Günther, Ann. Mag. Nat. Hist. xiv, 370, 1874; Bean, Proc. U. S. Nat. Mus. 1881, 252.)

# FAMILY CVIII (a)—AGONIDÆ.\*

(The Alligator-fishes.)

Body elongate, or more or less elevated, angular, covered with about eight longitudinal series of large bony plates, which form a coat of mail;

#### HYPSAGONUS Gill.

(Gill, Proc. U. S. Nat. Mus. 1861, 259: type Aspidophorus quadricornis Cuv. & Val.)

Body compressed and elevated, its depth greater than length of head, more than one-third the body; head small, separated from the base of the dorsal by a very deep nuchal depression; top of head very uneven; mouth terminal, the jaws about equal; no vomerine teeth; gill-membranes undescribed, probably free from isthmus; no barbels; scales large, not very rough, most of them striate and armed with a central spine or tubercle; dorsal spines strong, the first serrated; pectorals short, procurrent; ventrals small. ( $\dot{\psi}\psi_l$ , high; Agonus.)

## H. quadricornis (Cuv. & Val.) Gill.

Two horns above eye and 2 above occiput; interorbital space nearly as broad as

<sup>\*</sup>The following genera and species of this type have been described from Kamtschatka and the Kurile Islands, and will doubtles; be found on our Alaskan coast:

head externally entirely bony, the plates often spinous; eyes large, placed high; suborbital stay cuirassing the cheek; mouth terminal or inferior; barbels often present; teeth small, in villiform bands, on the jaws, and often on the vomer and palatines also; gills 3½, no slit behind the last; pseudobranchiæ very large, usually extending down the inner side of the opercle; gill-rakers small; gill-membranes united, free or joined to

eye; 2 small spines above snout; dorsals well separated. Hend 3#; depth 3. D. IX-6; A. 10; Lat. I. 33. Kamtschatka. (Günther.)

(Aspidophorus quadricornis Cuv. & Val. iv, 221, 1829: Agonus quadricornis Günther, ii, 215.)

#### HIPPOCEPHALUS Swainson.

(Swainson, Class. Fish. &c., 1839, 272: type Aspidophorus superciliosus Cuv. & Val.)

Body moderately elongate, compressed, the head depressed at the nape; dorsal spines strong, the first inserted close behind the nape; dorsals well separated; jaws equal, or the lower slightly the longer; breast granulated; gill-membranes not described, probably free. ( $i\pi\pi o \varepsilon$ , horse;  $\pi\varepsilon\varphi\alpha\lambda\eta$ , head.)

## H. japonicus (Pallas) Gill.

Yellowish brown, the body banded and the fins with dark lines. Top of head not very rough; a flat triangular prominence, directed upward and outward above each eye, concealing the eye when viewed from above; 2 spines above the snout; suborbital with 2 or 3 spines, one of them with a barbel; suborbital stay broad, gibbons; barbels small; bony plates rough-striate, pyramidal, the center raised; ventrals half as long as pectorals; dorsals separated by a space greater than length of either; fins all very rough. Depth 5. D. VI-17; A. 8; Lat. 1. 45. L. 12 inches. Kurile Islands. (Cur. & Val.)

(Cottus japonicus Pallas, Spicilegia fase, vii, 31, 1772: Agonus curilicus and Agonus stegophthalmus Tilesius, Mém. Ac. Petersb. iv, 416, 427: Aspidophorus superciliosus Cuv. & Val. iv, 215: Agonus stegophthalmus, Günther, ii, 214.)

#### Brachyopsis dodecaëdrus (Tiles.) Bean,

Brownish, body and fins banded. Body elongate; snout obtuse, depressed, without spines; mouth nearly vertical, the lower jaw considerably produced; interorbital space as wide as eye; suborbital with spines; breast with many small convex polygonal plates; keels of the scales ending in a small point. Head 5; depth 8. D. X1-7; A. 15; P. 15; V. I, 2; Lat. l. 40. Kamtschatka; common. (Cur. & Val.)

(Agonus dodekaëdrus Tiles, Mém. Ac. Petersb. iv, pl. 13, 1811: Phalangistes loricatus Pallas, Zoogr. Ross.-Asiat. iii, 114: Aspidodophorus dodecaëdrus Cuv. & Val. iv, 209: Agonus dodecaëdrus Gthr. ii, 214.)

## Siphagonus segalicusis (Tiles.) Steind.

Yellowish brown; fins with black bands. Form resembling Brachyopsis rostratus, but the tail shorter; body depressed; eye behind middle of head; two spines on the suborbital, and some others about eyes; dorsals contiguous; anal longer than second dorsal; no barbels under the throat; gill-membranes and barbels at chin undescribed. D. VII-8; A. 12; C. 10; P. 14; V. I, 2. L. 7 inches. Island of Saghalien. (Cur. & Val.)

(Syngnathus segaliensis Tiles. Mém. Soc. Imp. Nat. Moscou, ii, 216: Agonus luvigatus Tilesius, Mém. Acad. Petersb. iv, 436: "Aspidophore lisse" Cuv. & Val. iv, 214.)

the isthmus; ventral fins thoracic, close together, imperfect, I, 2 or I, 3; spinous dorsal small, sometimes absent; anal short, similar to soft dorsal, without spines; caudal narrow, few-rayed; pectorals entire, with broad base, the rays mostly simple; pyloric cœca few; air-bladder none. Small fishes, chiefly of the Arctic Seas. Genera about 10; species about 16. They feed chiefly on Crustacea, and are often found at considerable depths.

(Triglida, group Cataphraeti pt. Günther, ii, 211-216.)

- a. Spinous dorsal obsolete; gill-membranes free from the isthmus. (Aspidophoroidinæ.) Aspidophoroides, 381.
- aa. Spinous dorsal present.
  - b. Gill-membranes free from the isthmus; lower jaw projecting.

    - cc. Body fusiform, less elongate; snout not forming a tube; chin without barbel.

      Brachyopsis, 383.
  - bb. Gill-membranes united to the isthmus, lower jaw included.
    - d. Bony plates of body without spines.

      - ee. Vomerine teeth present; a deep pit at the occiput....Bothragonus, 385.
    - dd. Bony plates of body ending in spines.
      - f. Vomerine teeth present .......................Odontopyxis, 386.

# 381.-ASPIDOPHOROIDES Lacépède.

(Anoplagonus Gill.)

(Lacépède, Hist, Nat. Poiss. iii, 228, 1802: type Aspidophoroides tranquebar Lac. = Cottus monopteryqius Bloch.)

Body very long and slender, subterete, octangular, tapering into a very long six-sided tail. Head slender, short, with large eye; mouth small, terminal; jaws and vomer with villiform teeth. Dorsal fin single, without spines, very small, inserted nearly opposite the still smaller anal; other fins small; bony plates of body keeled, without spines; gill-membranes broadly united, free from the isthmus. ( $\delta\sigma\pi$ ), shield;  $\phi o\rho \delta \omega$ , to bear;  $\varepsilon c \delta o \varepsilon$ , appearance.)

a. Nasal spines very strong.

# 1109. A. monopterygius (Bloch) Storer.

Brownish, obscurely banded with darker; pectorals, dorsal, and caudal mottled or barred. Head triangular, much narrowed anteriorly; nasal spines very large, diverging, inserted near tip of snout; no other spines anywhere; eyes very large, longer than snout; supraocular ridges very high; a ridge extending backward from eye along tem-

poral region; lower jaw slightly included; caudal peduncle very long and slender, forming about two-fifths the length; breast with flat plates; dorsal ridges high anteriorly, the median line of back from snout to dorsal fin concave. Head  $5\frac{3}{3}$ ; depth 9. D. 5; A. 6; Lat. I about 50. L. 6 inches. Polar regions, southward to Cape Cod; abundant in deep water.

(Cottus monopterygius Bloch, Ausländische Fische, ii, 156, taf. 178; Günther, ii, 216.)

aa. Nasal spines obsolete. (Anoplagonus Gill.)

## 1110. A. imermis Günther.

Black, obscurely marbled with grayish and brownish; dorsal grayish, marbled with black; caudal black, with a gray band; anal yellowish, with a black dot behind each ray. Body anteriorly much broader than high. Head flat, depressed, triangular; nasal spines obsolete; lower jaw projecting; interorbital space grooved, narrower than the orbit; eye less than snout, 5 in head; pectorals shorter than head; ventrals small; breast with about 16 plates. Head 5 in total length; depth 14; width 9. D. 5; A. 5; C. 10; P. 10; V. 2; Lat. l. 41. Vancouver's Island. (Günther.)

(Günther, ii, 524: Anoplagonus inermis Gill, Proc. Acad. Nat. Sci. Phila. 1861, 167.)

#### 382.—SIPHAGONUS Steindachner.

(Steindachner, Ichth. Beiträge, v. 140, 1876: type Syngnathus segaliensis Tiles.)

Form of Syngnathus; snout produced in a tube; lower jaw projecting beyond upper, with a long barbel at the symphysis; gill-membranes free from the isthmus; both dorsals present; ventrals very short; plates of body slightly keeled, without spine. (Latin, sipho, tube; Agonus.)

# 1111. S. barbatus Steind.

Brownish, a lengthwise black band on sides of head, becoming obsolete behind. Body very slender, subterete; median line of head and back concave; snout produced into a long moderately-compressed tube, the single barbel at the chin about twice the length of eye; teeth on vomer; snout and orbital rim without spines; eye in middle of head; suborbital narrow, unarmed; preopercle with 3 spines; large polygonal scales on the breast; pectorals long, reaching dorsal; ventrals very short, the vent close behind them. Head 4; depth = length of snout, 9. D. VI-7; A. 9; P. 12; Lat. l. 44. L. 6 inches. Coasts of Alaska and Japan; not rare.

(Steindachner, Ichth. Beiträge, v, 140, 1876.)

## 383.—RRACHVOPSIS Gil.

# (? Leptagonus Gill.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 259: type Agonus rostratus Tilesius.)

Body elongate, fusiform, low, covered with spinous plates. Head depressed, spinous; mouth comparatively large, very oblique, the lower jaw projecting; jaws, vomer, and palatines with small teeth; gill-membranes united, free from the isthmus; barbels few; spinous dorsal well developed; ventral rays I, 2. ( $\beta \rho a \chi o \varepsilon$ , short;  $o \psi \iota \varepsilon$ , face.)

# 1112. B. rostratus (Tilesius) Gill.

Body more fusiform than in other species of this genus, very robust in front of the middle, tapering to the slender tail. Head triangular and pointed, as seen from above, the mouth quite narrow; eyes small, well forward; head considerably depressed, snont without spine; a short flap at angle of mouth; scales not very rough; gill-membranes free from the isthmus; ventrals quite short; breast with a median row of large raised convex plates; a row of similar plates bordering the edge of the gill-opening, the three series forming a \(\frac{1}{2}\)-shaped figure, the interstices filled with very small plates. "D. VIII-8; A.13"; Lat. l. 36. L. 8 inches. Alaska and Kamtschatka; here described from specimens lately obtained by Dr. Bean.

(Agonus rostratus Tiles. Mém. Acad. Petersb. iv, pl. 14: Phalangistes fusiformis Pallas, Zoogr. Ross.-Asiat. iii, 116: Agonus rostratus Günther, ii, 214.)

#### 1113. B. verrucosus Lockington.

Olivaceous, banded with darker; pectorals whitish at base, with a dark spot above and below; terminal portion dark; ventrals bright orange-yellow with a large black spot inside of the first ray, and two small spots near the tip in \$\delta\$, the fin plain in \$\delta\$. Body elongate, depressed; mandible narrow, not one-fourth as deep as long; maxillary reaching slightly beyond front of eye, with a short barbel at tip; length of barbel \$\frac{1}{4}\$ that of eye; ridges on head all rough; supraocular ridges serrate; occipital and postorbital ridges without spines; preorbital with about six spines; suborbital stay with two; preopercle with two spines near its angle; opercle without spines; membrane of mandible with small stellate tubercles; plates on body rough, each with a keel terminating in a strong spine; the dorsal plates with small prickles also; breast and base of pectoral fin with large, striate, wart-like tubercles; plates of ventral series tubercular anteriorly; upper lateral series of

plates reaching head; pectorals reaching the eleventh plate; ventrals extending beyond front of anal in 3, much shorter in 2; the membrane between the rays very broad; anal papilla small. Head 4½; depth 8. D. IX-7; A. 11; V. I, 2; P. 14; C. 10; Lat. I. 35. L. 8 inches. Coast of California; abundant in deep water.

(Lockington, Proc. U. S. Nat. Mus. iii, 60, 1880 (May 6): Agonus (Brachyopsis) barkani Steind. Ichth. Beiträge, ix, 253, 1880 (July 15).)

## 1114. B. xvosternus J. &. G.

Light olive brown, finely reticulated with darker, pale below; mandible, and sides of head below eye bright silvery; pectoral blackish, with a large light blotch at base below and a broad pale tip; caudal entirely black; dorsal nearly plain; ventrals plain; anal white anteriorly, abruptly black behind. Form of B. verrucosus, but rather stouter and less depressed; breast covered with minute prickles; plates of body with spines as in B. verrucosus, but without smaller prickles; ventral fins short, reaching, even in the male, little more than half way to anal; the connecting membrane of the rays very narrow; maxillary barbel long, three-fourths the diameter of the eye; mandible very deep, more than one-third as deep as long; upper lateral series of plates obsolete from front of first dorsal forward. Head 4½; depth 7. D. VI-6; A. 8; V. I, 2; P. 17; Lat. l. 30. L. 5½ inches. About Monterey and San Francisco; common about Santa Cruz.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 152, 1880 (July 2): Agonus (Brachyopsis) anuw Steindachner, Ichth. Beiträge ix, 254, 1880 (July 15).)

## 1115. B. (?) decagonus (Bloch & Schneider) J. & G.

Yellowish brown, marbled with darker. Body elongate, compressed; head depressed; jaws equal; a pair of spines above the snout, a second above the orbits, a third on the nape, the latter the largest; barbels very short and thick; scales with very prominent spines; six series of scales between the ventral fins and the vent; four between the vent and the anal fin; pectoral fins much longer than head, one-fourth total with candal. D. V1-7; A. 8; P. 14; Lat. l. 41. Greenland to Norway. (Günther.)

(Agonus decagonus Bl. & Schn. 1801, 105: Agonus decagonus Günther, ii, 215: Agonus decagonus Collet, Norges Fiske, 1875, 40: Archagonus decagonus Gill: Aspidophorus spinosissimus Kröyer, Naturhist. Tidsskr. i, 250, 1844: Agonus spinosissimus Günther, ii, 214: Leptagonus spinosissimus Gill, Proc. Acad. Nat. Sci. Phila. 167, 1861.)

#### 384 .- AGONUS Bloch & Schneider.

(Aspidophorus Lacépède: Phalangistes Pallas.)

(Bloch & Schneider, Syst. Ichth. 104, 1801: type Cottus cataphractus L.)

Body low; head broad, depressed, about as broad as long; mouth small, subinferior, the lower jaw included; no vomerine teeth; gill-membranes joined to the isthmus, forming a narrow fold across it; plates on body without spines; fins short. One species known. ( $\alpha$ , without;  $\gamma \omega z \alpha z$ , joint: *i. e.*, rigid.)

# 1116. A. cataphractus (L.) Bloch & Schneider.—Sea Poacher.

Brownish, sides with some dark bands; pectorals and upper fins Body anteriorly very broad, flattened below, tapering abruptly forward to the triangular snout, and slowly backward to the long and slender tail; the greatest width is half more than the greatest height and 5 times the least height; snout with four sharp, hooked spines projecting much beyond the horizontal \(\Omega\)-shaped mouth; lower jaw profusely covered with thickish barbels, the largest longer than eve; suborbital narrow, with three blunt bony projections; preopercle and subopercle each with a stout spine, that on subopercle the larger and hooked backward; bones of head striate; orbital crests elevated. roughish; interorbital space broader than eye; top of head little uneven, without spines; two blunt occipital processes; no nuchal depression; the space between dorsal ridges concave; plates on body rugose; lateral plates much smaller than others, the upper lateral series obsolete from middle of spinous dorsal forward, in which region the lower lateral series is much enlarged; breast with four quadrate plates forming a square. Dorsal small; pectoral about as long as head, reaching to within four plates of anal; ventrals short, reaching little beyond vent,  $6\frac{2}{3}$  in length. Head about as broad as long,  $4\frac{1}{3}$ ; depth 6. D. V-7; A. 5; Lat. l. 35; eeca 5; vertebræ 11 + 25. Northern Europe; recorded, perhaps erroneously, from Greenland.

(Cottus cataphractus L. Syst. Nat. i, 451: Aspidophorus armatus Lacép. iii, 222; Günther, ii, 211; Day, Fishes Great Britain, 1881, 67.)

## 385.—BOTHRAGONUS Gill.

(Gill, Bull. U. S. Nat. Mus. xi, ined.: type Hypsagonus swani Steindachner.)

Body rather short and deep, broad and depressed anteriorly, compressed behind; a deep nuchal pit; mouth subinferior, the lower jaw included; head and neck to the dorsal fin rhombic in outline, as seen from above; jaws and vomer with teeth; dorsals small, well separated;

anal similar to soft dorsal; ventral I, 2; plates without spines or keels; no spines on head. Gill-membranes broadly united to the isthmus. North Pacific. (βοθρος, a cavity; αγωνος, Agonus.)

# 1117. B. swani (Steindachner) Gill.

Clear yellowish; a blackish cross-bar downwards and forwards from base of first dorsal; another between the dorsals, and a third behind dorsal and anal; a dusky bar across interorbital space and through eye; fins all mottled or barred. Nuchal pit broader than long, the plates behind sending three processes into it; top of head with two broad parallel ridges, the space between them transversely concave; preopercular margin denticulated; breast with large plates, similar to those on sides of body. Head 3½; depth 3½. D. III-5; A. 5; P. 12; C. 12; V. I, 2; Lat. l. 32. Puget's Sound; one specimen known. (Steindachner.)

(Hypsagonus swanii Steindachner, Ichth. Beiträge, v, 144, 1876.)

# 386.-ODONTOPYXIS Lockington.

(Lockington, Proc. U. S. Nat. Mus. ii, 328, 1879: type Odontopyxis trispinosus Lock.)

The genus differs from *Podothecus* chiefly in the presence of vomerine teeth. The body is very slender, and the fins few-rayed.  $(o\delta\omega\nu, tooth; \pi v \xi \iota \xi, box.)$ 

## 1118. O. trispinosus Lock.

Olivaceous, with six or seven darker bands; fins with dark blotches. A sharp, rather long, movable spine upon the tip of the snout, its triangular base projecting beyond the jaws; behind this a pair of recurved, fixed spines; supraorbital ridge prominent, ending in a backward-directed spine; maxillary with two minute barbels; isthmus broad; eye very large; forchead strongly convex, longitudinally transversely strongly concave; a deep nuchal cavity divided by a longitudinal ridge; preorbital with a spine directed backward; eye large; a circlet of horizontal spines at base of caudal. Head  $5\frac{1}{2}$  in total length; depth 10 to 12; eye  $3\frac{2}{3}$  in head. D. IV-6; A. 6; V. I, 2; P. 14; C. 11; Lat. l. 36. L. 3 inches. Pacific Coast from San Francisco to Santa Barbara.

(Odontopyxis trispinosus Lockington, Proc. U. S. Nat. Mus. ii, 328, 1879.)

# 387.—PODOTHECUS Gill.

(Paragonus Gill.)

(Gill, Proc. Nat. Sci. Phila. 1861, 259: type Podotheeus peristethus Gill = Agonus acipenserinus Tiles.)

Body elongate, fusiform; head long, compressed, armed above; snout protruding much beyond the small, inferior, U-shaped mouth; teeth

very small, in villiform bands; none on vomer or palatines; lower parts of head with barbels; gill-membranes united to the isthmus, not forming a fold across it. Plates of body armed with spines; spinous dorsal present. Ventral rays I, 2.  $(\pi \sigma \sigma_5, \text{ foot }; \theta_{\eta} z_{\eta}, \text{ box, from a supposed groove for the reception of the ventrals.})$ 

# 1119. P. vulsus J. & G.

Dark brown, with 7 to 9 darker cross-bars, extending on the fins; pectorals black, with whitish edging and a pale blotch near base; other fins chiefly black, the anal with whitish edging; belly white. Body very elongate, broader than high. Head triangular, the profile irregular, the snout pointed. Mouth A-shaped, entirely inferior, the maxillary reaching front of pupil; distance from premaxillaries to tip of rostral spines, about half length of snout; maxillary, interopercle, and branchiostegals, with scattered cirri, these fewer and smaller than in P. acinenserinus: none on lower side of snout. Eve large, as long as snout, 33 in head; the orbital rim prominent all around. head more numerous than in the other Agonida. Snout with two strong spines directed forwards, two large ones behind them directed upwards, then two smaller ones; orbital ridge elevated and serrated, with a preocular and a supraocular spine; behind the latter, a ridge armed with two spines on each side, separated from the first plates of the dorsal series by a deep quadrangular pit; a row of minute, erect spines on median line of back and top of head; a sharp, serrated, temporal ridge, with four spines; opercle with a strong rib and several spines; suborbital stay with an irregular prominent ridge; preopercle with three principal spines and some smaller ones; suborbital narrow, half width of eye, extremely uneven, armed with small spines and tubercles; more than 70 spines and tubercles on the head. Plates of body all striate, those above and on sides ending each in a sharp spine; breast with about six polygonal plates, on each side of which are the plates of the abdominal series; bases of caudal and pectorals with small spines. Ventrals short, the vent near the middle of their length. Head 4; depth 8. D. IX-7; A. 9; Lat. l. 40. L. 4½ inches. Deep water, off San Francisco; not common.

(Agonus vulsus Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 303, 1880.)

# 1120. P. acipenserinus (Tiles.) Gill.—Alligator fish.

Brown with darker marblings and narrow vertical streaks; fins olivaceous, more or less marbled with dark; ventrals plain, black in  $\delta$ ; a

dark bar at base of pectorals; belly white. Body elongate, the tail very slender, broader than deep; head narrow, the cheeks subvertical, the shout long and pointed; mouth  $\Omega$ -shaped, wholly inferior; distance from premaxillaries to tip of nasal spines less than half snout; maxillary and lower side of snout with dense tufts of long cirri as long as eye; a few on mandible, none on branchiostegal region. Eve large, shorter than snout, 4 in head; orbital rim prominent above only; snout with two spines directed forward, then two larger ones hooked backward, far behind which are two smaller ones close together, directed upward: orbital bones rugose, with a strong supraocular spine only; behind it a sharp occipital ridge on each side, each ending in a single spine; no pit at the occiput, the vertex nearly plane; operele and preoperele strongly striate, the latter with a ridge and a blunt spine; suborbital very broad, nearly as deep as eye, striate, with a double ridge at its lower margin, the upper ridge with two or three spines; head with about 18 distinct spines in all. Plates of body strongly striate, those above ending in . strong spines; breast with about twelve polygonal plates; slight asperities at base of pectoral; ventrals very short, not longer than eye in 9, about half longer than eye in  $\delta$ ; pectorals large, about reaching anal; caudal peduncle long, about half length of body without head; dorsals high in 3, the two fins closely contiguous. Head 33; depth 6. D. IX-7; A. 8; Lat. l. 37; vert. 12 + 27. L. 12 inches. Puget Sound to Alaska; common northward.

(Agonus acipeuscriuus Tilesius, Mém. Acad. St. Petersb. iv, 422, 1813. Agonus acipeuscrinus Günther, ii, 212: Podothecus peristethus Gill, Proc. Acad. Nat. Sci. Phila. 1861, 260: Paragonus acipeuscriuus Gill, 1. c. 167: Agonus acipeuscriuus Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 332, 1880.)

# Family CVIII (b).—TRIGLIDÆ.\*

(The Gurnards.)

Body elongate, usually more or less fusiform, covered with scales or series of bony plates. Head externally bony, usually entirely cuirassed with rough, bony plates, some of which are armed with spines; eyes high; mouth terminal or subinferior; premaxillaries protractile; maxillary without supplemental bone, slipping under the preorbital; teeth very small, in bands in the jaws, and usually on the vomer and palatines, sometimes entirely wanting; gills 4, a large slit behind the fourth; pseudobranchiae present; gill-rakers varions; gill-membranes

<sup>\*</sup> Family 108 (a), Agonidae is included under Triglidae, in the key to families, on page 79.

free, or variously attached to the isthmus. Ventral fins thoracic, usually wide apart, separated by a flat area, I, 4 or I, 5. Spinous dorsal present, short; soft dorsal similar to the anal, which is without spines; caudal narrow, few-rayed. Pectorals large, with broad base, sometimes divided into two portions, sometimes with the two or three lowermost rays detached. Air-bladder present; pyloric ceca usually present, few in number. Singular looking fishes, allied to the *Cottide*, found in all seas. Genera 5; species about 40.

(Triglida pt. Günther, ii, 191-210, 216-224.)

- Pectoral fins, with two or three detached appendages below; ventrals I, 5, wide apart.
  - b. Body mailed; teeth none; pectoral appendages 2. (Peristediina.)

Peristedium, 388.

- bb. Body scaly; teeth present; pectoral appendages 3. (Triglinæ.)
- aa. Pectoral fin divided to the base, into two unequal parts; ventrals I, 4, contiguous; gill-membranes broadly attached to the isthmus. (Dactylopterina.)

  CEPHALACANTHUS, 391.

## 388.-PERISTEDIUM Lacépède.

(Peristedion Lacépède, Hist. Nat. Poiss, iii, 368, 1802: type Peristedion malarmat Lac. = Trigla cataphracta Gmelin.)

Body elongate, fusiform, covered with bony plates, each of which is armed with a strong spine; head bony; each preorbital produced into a long flat process, which projects more or less beyond the mouth; mouth small; teeth none; lower jaw included, provided with barbels; gill-membranes separate, narrowly joined to the isthmus anteriorly; gill-rakers slender. Dorsal fin continuous or divided. Pectoral fin short, with the two lowermost rays detached. Ventrals I, 5, separated by a broad flat area. Air-bladder simple. Pyloric cœca about 10. Warm seas. Color generally red. ( $\pi \varepsilon \rho \iota$ , around;  $\sigma \tau \varepsilon \theta \iota o \nu$ , diminutive of  $\sigma \tau \varepsilon \theta o \varepsilon$ , breast; the breast being mailed.)

#### 1121. P. miniatum Goode.

Bright crimson. Armature of body essentially as in *P. brevirostre*;\* spines of abdominal plates very weak posteriorly; length of preorbital process 3½ in distance from its extremity to front of orbit; interorbital space deeply concave; protuberance on the forehead very slight; a pair of spines on upper surface of snout behind base of preorbital processes; a larger pair on preorbital processes; ridge of preopercle ending in a depressed, short, sharp-pointed spine; about ten small

<sup>\*</sup>See Günther, Cat. Fish. Brit. Mus. ii, 218, 1860.

tentacles on each side of lower jaw, those near the symphysis smallest. Long tentacles at angle of mouth fringed, extending to bases of pectorals. Head 2½; depth 5. D. VII-18; A. 17; C. 16; P. 2-10; V. I, 5; Lat. l. 28. L. 12 inches. Gulf Stream, off the coast of Rhode Island. (Goode.)

(Goode, Proc. U. S. Nat. Mus. 1880, 349.)

# 389.-TRIGLA Linnans.

## Gurnards.

(Artedi; Linnæus, Syst. Naturæ, 1758: type, Trigla lyra L.)

This genus differs from *Prionotus* chiefly in the absence of palatine teeth. The scales are smaller and the pectoral fins less developed; a series of bony, spinous plates extend along the base of the dorsal fins, a pair of them to each ray, the fin thus running in a shallow groove; caudal fin usually emarginate. Lateral line usually forking at base of caudal, the branches running to tip of fin. The numerous species abound on the coasts of Europe, Africa and India.  $(\tau \rho v \gamma \lambda a, \text{ elassical name of } Mullus \ barbatus; \text{ transferred to this group for no evident reason.)}$ 

## 1122. T. cuculus Linn.—Red Gurnard.

Rose-red; profile of snout rather steep, slightly concave; preorbital with short denticulations; maxillary nearly reaching front of orbit; lateral line with a series of unarmed plates, which are deeper than long; first dorsal spine tuberculated; second longest,  $\frac{2}{3}$  length of head; pectoral reaching past front of anal. Head  $3\frac{1}{2}$ ; depth 5. D. IX-18; A. 17; Lat. l. 75. Common in Europe; said by Cuvier to have been once brought from New York by Milbert.

(Linn. Syst. Nat.: Trigla pini Günther, ii, 199; Day, Fish. Gt. Brit. 1880, 58.)

# 390.—PRIONOTUS Lacépède.

# Sea Robins.

(Lacépède, Hist. Nat. Poiss. iii, 337, 1802: type Trigla evolans L.)

Body subfusiform; profile of head descending to the broad depressed snout, which is much longer than the small eye; eyes close together, high up; surface of head entirely bony, the bones rough with ridges and granulations; scales on head few or none; preoperele with one or two sharp spines at its angle; opercle with a sharp spine; nape with two strong spines; a spine on shoulder girdle. Mouth rather broad; bands of small, almost granular, teeth on jaws, vomer and palatines; gill-

membranes nearly separate, free from isthmus; gill-rakers rather long. Body covered with small, rough scales, which are not keeled; lateral line continuous; scales of breast very small. Dorsal fins distinct, the first of 8 to 10 rather stout spines; anal fin similar to soft dorsal; pectoral fin with the three lower anterior rays thickened, entirely free from each other and from the fin; ventrals I, 5, wide apart, with a flat space between them, the inner rays longest. Pyloric cocca in moderate number; air-bladder generally with lateral muscles, and divided into two lateral parts; vertebrae 10 or 11 + 15. Species about 10, representing in America the old world genus Trigla. ( $\pi\rho i\omega v$ , saw;  $\nu \omega \tau \sigma \tau$ , back; three free, saw-like spines being said to intervene between the two dorsals.)

- a. Mouth small, mandible not reaching vertical from front of orbit: preopercular spine without conspicuous basal cusp; blotches on spinous dorsal well defined, occllated; a transverse groove connecting the upper posterior angles of orbit. (Ornichthys\* Sw.)
  - b. Body very slender; sides with numerous round brownish spots.

# 1123. P. punctatus (Bloch) Cuv. & Val.

Dark olive brown, back and sides covered with numerous round bronze spots, larger than the pupil; spinous dorsal dusky, with lighter streaks and two black ocellated spots; second dorsal and upper half of candal spotted; anal blackish, with a pinkish border; pectorals blackish, the free rays barred with light and dark; ventrals pale; branchiostegal membrane pinkish. Pectorals short, reaching only to middle of soft dorsal, 24 in length to base of candal; first dorsal high. much slenderer than in any of the other species. Band of palatine teeth very slender, shorter than eye; maxillary one-third length of head; preorbital without spines; opercle scaleless; gill-rakers shortish; Head 31; depth 6. D. X-13; A. 12; Lat. i. about 10 below angle. about 75. West Indies, north to North Carolina; not rare southward. Here described from specimens from North Carolina, perhaps belonging to a species distinct from the true punctatus, which is described as less slender.

(? Trigla punctata Bloch, Ausl. Fisch. taf. 352; ? Cuv. & Val. iv, 93; ? Günther, ii, 193; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 373.)

bb. Body rather robust; sides of body without conspicuous spots.

## 1124. P. palmipes (Mitch.) Storer.

Brownish above, clouded with darker; throat and branchiostegals dark; a distinct black blotch above on membrane between fourth and

<sup>\*</sup>Swainson, Class. Fish. etc., 1839, 262: type Trigla punctata Bloch. (oprts, bird;  $i\chi\theta\psi$ s, fish.)

fifth dorsal spines, this occilated below; 2 longitudinal light streaks below dorsal blotch; second dorsal with oblique whitish streaks. Head comparatively smooth above. Preopercular spine strong; opercle scaleless; band of palatine teeth short and broad, shorter than eye. Pectorals short, not reaching middle of second dorsal,  $2\frac{1}{3}$  in length; pectoral appendages strong, more or less dilated at their tips; ventrals long, reaching anal; gill-rakers rather short, about 10 below angle; maxillary  $3\frac{1}{3}$  in head. Head 3; depth 5. D. X-13; A. 12; Lat. l. 58. Atlantic coast of the United States; common northward.

(?? Trigla carolina Linnaus, Mantissa, ii, 528: Trigla palmipes Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 431, 1815: Prionotus pilatus Storer, Proc. Bost. Soc. Nat. Hist. ii, 77: Prionotus palmipes and P. pilatus Storer, Fish. Mass. 18: Prionotus carolinus C. & V. iv, 90: Prionotus carolinus Giinther, ii, 192.)

aa. Mouth large, mandible reaching at least the vertical from front of orbit; no distinct transverse groove between and behind the eyes; preopercular spine with a smaller one at base; dorsal blotch diffuse, not occllated. (Prionotus.)

#### 1125. P. tribulus Cuv. & Val.

Dark brown above, with darker blotches and numerous small, pale spots; belly pale; a black blotch at base of mandible; membrane of spinons dorsal, between the third and sixth spines, with a black blotch above; second dorsal with brownish spots, forming oblique bars, and with 2 dark blotches at base, the posterior blotch continued obliquely downwards and forwards to below the lateral line; pectoral olive brown, with dark cross-bars, which are more distinct towards the tip of the fin; its upper edge white; pectoral appendages with dark spots; basal half of caudal paler. Pectorals rather short, not reaching end of dorsal, 2 in length to base of caudal; pectoral appendages thick, Body robust. Head shorter and broader, snout shorter, and bones more strongly striate than in P. evoluns; interorbital space deeply concave; occipital and supraorbital spines very strong and much compressed; band of palatine teeth as long as eye; gill-rakers shortish, 9 below angle; membranous edge of opercle scaly. Head 24 in length; depth 4. D. X-12; A. 11; Lat. I. about 50. South Atlantic coast of the United States; abundant.

(Cuv. & Val. iv, 98, 1829; Günther, ii, 195; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 374.)

## 1126. P. evolans (Linn.) Gill.

Similar to var. *lineatus*, but spotted also with white; the pectorals plain black, with pale edgings above, longer than in var. *lineatus*, reaching usually past the end of the second dorsal and anal,  $1\frac{1}{2}-1\frac{3}{4}$  in

length to base of caudal. Body and head stouter, the plates rougher; scales somewhat larger, in about 55 series. Atlantic coast; common southward.

(† Trigla evolans L. Syst. Nat.; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 374.)

Subsp. lineatus (Mitch.) J. & G.

Olive brown above, mottled and spotted with blackish; whitish below: a narrow dark streak along the lateral line, with a broader one below it, which terminates behind in a series of spots and blotches; lower jaw and branchiostegal membranes sometimes bright orange-yellow: pectorals blackish, edged with olivaceous and orange, with numerous transverse dark lines: membrane of spinous dorsal with a black blotch between third and sixth spines; soft dorsal plain or with 2 black blotches at base; ventrals and anal orange; pectoral appendages slender, dusky. Gill-rakers rather long and slender, 15 below angle; band of palatine teeth wide, shorter than eve; spines on head moderate in size, compressed, the one at upper posterior angle of orbit little developed: membranous edge of opercle scaly; ventral reaching to front of anal: pectoral reaching to past middle of soft dorsal and anal, from 17 to 24 in length. Head 23 in length; depth 43. Eye 23 in snout. X-12; A. 11; Lat. I. about 60. Cape Cod to Cape Hatteras; common Perhaps a distinct species, but seeming to vary into the northward. preceding.

(Trigla lineata Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 430, 1815: Prionotus lineatus Storer, Hist. Fish. Mass.: Prionotus lineatus Günther, ii, 192: Prionotus strigatus Cuv. & Val. iv, 86.)

# 1127. P. stephanophrys Lockington.

Pale olivaceous, abruptly white at level of pectorals; back and sides with a few scattered dark spots; branchiostegals mostly saffron-yellow; spinous dorsal dusky, with a diffuse dark blotch between fourth and fifth spines, near edge of membrane; second dorsal spotted; caudal with dark blotches; pectorals dark, with large round black spots. Body rather stout; head large, compressed, broad, and very nearly plane above; the interorbital region not concave; no transverse furrow behind orbits; orbital rim with a slightly raised, serrated crest; snout very short, two-fifths length of head; mouth large, the broad maxillary reaching beyond front of orbit; bands of palatine teeth very narrow; gill-rakers long and slender; head less rough than usual, the bones little striate; occipital processes not reaching first dorsal spine; preorbital little projecting; preopercle with a strong smooth spine,

reaching slightly beyond membrane of opercle; opercle ending in two points, the lower a long spine, the membrane connecting the two scaly; scales thin, cliate, not closely imbricate; first dorsal spine granulate in front; pectorals reaching beyond middle of anal, about to base of ninth ray; free rays very slender, the uppermost more than half length of fin; ventrals not reaching vent; caudal slightly emarginate. Head  $2\frac{1}{3}$ ; depth 4; eye  $1\frac{1}{3}$  in snout. D. X-12; A. 11; P. 13-111; Lat. l. 55. Deep water off San Francisco; one specimen known.

(Lockington, Proc. U. S. Nat. Mus. 1880, 529.)

# 391.—CEPHALACANTHUS Lacépède.

Flying Gurnards.

(Dactylopterus Lacépède, iii, 325.)

(Lacépède, Hist. Nat. Poiss. iii, 323, 1802: type Gasterosteus spinarella Linn.)

Body elongate, subquadrangular, tapering behind; head very blunt, quadrangular, its surface almost entirely bony; nasals, preorbitals, suborbitals, and bones of top of head united into a shield; nuchal part of shield on each side produced backward in a bony ridge, ending in a a strong spine, which reaches past front of dorsal; interocular space deeply concave; preorbitals forming a projecting roof above the jaws; preopercle produced in a very long rough spine; cheeks and opercles with small scales; opercle smaller than eye; gill-openings narrow, vertical, separated by a very broad, scaly isthmus; pseudobranchiae large: gill-rakers minute; mouth small, lower jaw included; jaws with granular teeth; no teeth on vomer or palatines; scales bony, strongly keeled; 2 serrated, knife-like appendages at base of tail; first dorsal of 4 or 5 rather high flexible spines, the first one or two spines nearly free from the others; an immovable spine between the dorsals; anal and second dorsal short, of slender rays; candal small, limate; pectoral fins divided to the base into two parts, the anterior portion (corresponding to the free rays in *Prionotus*) about as long as the head, of about 6 rays, closely connected; the posterior and larger portion more than twice length of head, reaching nearly to caudal in the adult ("Dactylopterus" Lac.); much shorter in the young ("Cephalacanthus" Lac.); these rays very slender, simple, wide apart at tip; ventrals I, 4, long, pointed, their bases close together, the inner rays shortest; air-bladder with two lateral parts, each with a large muscle; pyloric cæca numerous; vertebræ 9 + 13. Warm seas; the adult able to move

Bull. Nat. Mus. No. 16——47

in the air, like the true flying-fish, but for shorter distances. (zεψαλη, head; αzανθα, spine.)

a. Occiput without filament.

1128. C. spinarella (L.) Lac.—Flying-robin; Bat-fish; Volador.

Greenish olive and brown above, of varying shades; below pale, marked irregularly with dusky and bright brick-red, varying to salmonyellow; pectoral fins mottled with bright blue streaks near the base, and blue spots and bars toward the tip; their under sides glaucousblue, edged with darker; caudal fin with about three brownish-red bars; coloration extremely variable. First two dorsal spines free, slightly connected by membrane at base; preopercular spine reaching beyond base of pectorals, not to end of occipital spine; pectorals reaching nearly to base of caudal. Head 4\frac{1}{3}; depth 5\frac{1}{2}. D. H-IV, 8; A. 6; P. 28, 6. L. 12 inches. Atlantic Ocean, on both coasts; abundant southward.

(Gasterosteus spinarella L. Syst. Nat. i, 492 (young): Trigla rolitans Linn. Syst. Nat. i, 498 (adult): Trigla rolitans Gmelin, Syst. Nat. 1788, 1346: Daetylopterus rolitans Günther, ii, 221: Daetylopterus rolitans Lütken Spolia Atlantica, 1880, 417; Günther, ii, 224.)

# FAMILY CIX.—LIPARIDIDÆ.

(The Sea Snails.)

Body more or less elongate, subcylindrical anteriorly, compressed behind, covered with smooth skin, which is usually very lax. Head broad, obtuse, the snout short; suborbital bone styliform behind, joined to the preopercle, as in the Cottide; jaws with bands of small teeth, which are usually tricuspid; no teeth on vomer or palatines; premaxillaries protractile, little movable; opercular bones unarmed; interopercle slender, ray-like, overlying the branchiostegals; gill-openings small, the membranes joined to the broad isthmus, and to the humeral arch below. Gills 34; no slit behind the last; pseudobranchiæ rudimentary or wanting; pyloric cœca numerous; no air-bladder; dorsal fin rather long, the spines feeble and flexible, low, similar to the soft rays; anal long, similar to the soft dorsal; ventral fins I, 5, the two completely united, and forming the bony center of an oval suckingdisk; ventrals sometimes entirely wanting; pectoral fins very broad, the base procurrent; the outline usually emarginate, some of the lower rays being produced; tail diphycercal; caudal fin short, convex; vertebræ 12 + 30. Genera 3; species about 20. Small fishes, nearly all of the northern seas.

(Discoboli; group Liparidina Günther, iii, 158-165.)

- a. Ventral disk entirely wanting. (Amitrium.)
- - - cc. Ventral disk well developed; vent well behind head......LIPARIS, 394.

#### 392.-AMITRA Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, 478; type Amitra liparina Goode.)

Body clongate, attenuate backward, covered with lax, smooth, slimy skin, which is separated from the body and fins by a filmy mucons intertissue. Head small, thick, convex between eyes; snout convex, protruding; mouth small, horizontal, the lower jaw included; teeth small; eyes lateral; gill-openings restricted to small slits above the base of the pectorals, covered by the very small opercle; no barbels; dorsal and anal fins many-rayed; dorsal continuous, almost concealed by the skin; the spines scarcely different from the soft rays; anal similar to dorsal; both connected with the candal, which is pointed; no trace of ventral fins or sneking disk; pectoral fin very broad, procurrent, its lower rays inserted nearly under the eye, the fin emarginate; vent well behind head. One species known; its position intermediate between the Cottidæ (Cottunculus, Psychrolutes) and Liparididæ, two groups much more intimately related than most writers have conceded.\* (a, without; parpa, stomacher.)

# 1129. A. liparina Goode.

Yellowish white, dusky toward the tail and front of head; peritoneum black. Body posteriorly compressed, the tail very thin; eyes half width of interorbital space, 5 in head; upper lip with pores. Dor-

<sup>\*</sup>I should put the family of Gobiesocida far away, at least a suborder off, from the Cyclopterida and Liparidida, which are far more closely united to the true Cottida, represented by Cottus and Hemitripterus, than to either the Gobiesocida proper or to the Gobies and Blennies. In fact, Liparis has as close affinities, as shown by its skeleton. with Cottus and Hemitripterus as with Cyclopterus; and we have in the three groups, represented by Cottus, Liparis, and Cyclopterus, well-marked families of the same suborder. The only character by which the Cyclopterida and Liparidida are closely united consists in the peculiar formation of the ventral disk by the union of the ventral fins: but as this structure is simply brought about by the modification of the rays in a manner common to the several genera, and not by any marked anatomical difference in the structure of the same fins in Cottus, I can only look upon it as a generic character common to the known representatives of both families of Cyclopterida and Liparidida: and the discovery of a representative of either family with ventral fins of the ordinary form would not necessitate the establishment of a family for its reception, as in that care we should simply consider the structure as of generic value. (Putnam, Proc. Am. Ass. Adv. Sci. 1873, 337.)

sal beginning over pectoral; anal under ninth dorsal ray. Head  $6\frac{2}{3}$ ; depth  $5\frac{1}{2}$ . D. V, 62; A. 54; C. 6; P. 23. L. 5 inches. Deep water off the coast of Rhode Island; lately dredged by the U. S. Fish Commission.

(Goode, Proc. U. S. Nat. Mus. 1880, 478,)

## 393.—CAREPROCTUS Kröver.

(Kröyer, Naturh, Tidsskr. i, 257, 1852; type Liparis reinhardi Kröyer.)

Body elongate, semi-transparent, covered with thin lax skin; mouth oblique, the lower jaw projecting; teeth simple, hooked; ventral disk small, situated far forwards, under front of eye; vent a little behind it, far in front of anal fin.  $(z\alpha\rho\alpha, \text{head}; \pi\rho\omega\alpha\tau\delta\tau, \text{vent.})$ 

# 1130. C. gelatinosus (Pallas) Kröyer.

Rose-colored; vertical fins violet; gill-cavity black. Ventral disk very small, supported by a bilamellate cartilage descending from the throat; vertical fins continuous. Body oblong, compressed, semi-transparent, soft, and gelatinous; head thick, flat above; cleft of mouth nearly vertical, as in *Uranoscopus;* a series of pores along upper lip; jaws, palate, and pharynx rough with teeth; skeleton very weak. D. more than 50; A. about 45; C. 6; P. 30; cœca 48; vertebræ 64. (Günther.) Alaska and Kamtschatka; Greenland.

(Cyclopterus yelatinosus Pallas, Spicilegia, vii. 19, 1769: Liparis gelatinosus Giinther, iii, 163? ? Liparis yelatinosus Reinh. Oversigt, &c. 1844, lxxvii: ? Liparis reinhardi Kröyer, Naturh. Tidsskr. i. 252: ? Careproctus reinhardi Kröyer, l. c., 257, the Greenland form, thought by Dr. Kröyer to be different from C. gelatinosus.)

## 391.-LIPARIS Linnaus.

#### Sea-Snails.

(Artedi; Linnens, Syst. Nat.: type Cyclopterus liparis L.)

Body rather elongate, covered with smooth skin, which is usually freely movable; head short, flattened above; mouth horizontal, the lower jaw included; teeth in several series, usually tricuspid; maxillary covered by skin of preorbital region; ventral disk well developed, on the breast, its front below or behind the middle of the head; vent well behind the head, about midway between sucking-disk and anal fin. Dorsal fin continuous or divided, its spines hardly differentiated; dorsal fin free from caudal or not; pectoral emarginate, some of the lower rays produced; vertical fins enveloped in skin. Northern seas (one species known from Chili). ( $\lambda i\pi a\rho \delta i$ , sleek-skinned, shining.)

a. Dorsal fin continuous. (Liparis.)

b. Dorsal fin connected with the caudal.

## 1131. L. major (Walb.) Gill.

Dorsal and anal slightly connected with base of caudal; anterior nostrils tubular; posterior simple. D. 45; A. 38; P. 42; C. 10. Size very large. L. 10 inches. Greenland. (Gill.)

(Uyelopterus liparis var. major, Walb. Artedi Pisc. 489, 4792; Liparis tunicata Kröyer, Naturh. Tidsskr. i, 236, 4862; Actinochir major Gill, Proc. Acad. Nat. Sci. Phila. 4864, 493.)

# 1132. L. pulchella Ayres.

Grayish, usually with wavy purplish stripes, sometimes marbled and spotted with purplish; pectorals spotted or banded with grayish purple; lateral line with round whitish spots. Snout broad and blunt, projecting beyond month; maxillary reaching nearly to front of eye; teeth short, close-set, a broad band in each jaw, that of upper jaw broadest. Body compressed behind, thick in front; head almost globular; anterior nostrils tubular; skin very thin and lax. Dorsal fin high, undivided, continuous with anal and caudal around the tail; tail tapering to a point, appearing isocercal, but the vertebrae essentially as in other species; pectorals very broad, the base of lowermost rays under eye; ventral disk small, oval,  $2\frac{1}{2}$  in head; pseudobranchiae well developed. Head 5; depth 5. D. 48; A. 39; C. 12; P. 36. L. 10 inches. Pacific Coast, from Monterey to Puget Sound; not rare.

(Ayres, Proc. Cal. Acad. Nat. Sci. i, 1855, 23; Günther, iii, 164; Steindachner, Ichth. Beiträge, iii, 53, 1875.)

#### 1133. L. gibba Bean.

Head and body very pale brown or gray, paler below; head and anterior parts often with concentric brown rings; sides plain or marked with brown stripes and rings; tail sometimes with dark blotches; vertical fins usually with dark bands. Body abruptly contracted near the vent, covered with lax skin; interorbital space shallow-concave, the vertex and nape somewhat elevated; snout depressed; head as wide as long, longer than deep; nostrils tubular, the tubes of anterior nostrils longest; eye small, 4 in head; ventral disk nearly circular, 8 in length; vertical fins confluent; dorsal continuous; longest dorsal ray half as long as head; pectorals reaching front of anal; caudal 6 in body. Head 31; depth 31. D. 42; A. 36; P. 35; C. 12. Bering's Sea. Alaska and Siberia. "Distinguished from L. fabricii by its smaller eye and its depressed snout," and from "L. tunicata" by the larger eye and fewer rays in dorsal, anal, and pectorals. (Bean.)

(Bean, Proc. U. S. Nat. Mus. iv, 148, 1881.)

## 1131. L. arctica Gill.

Uniform dark rusty-brown or chestnut. Snout rather high and decurved; interorbital space 3 in head; forehead depressed; anterior nostrils simple, posterior tubular. Vertical fins confluent; caudal convex, 7 in total length; pectoral  $5\frac{1}{3}$ ; ventral disk 10. Head 4 in total, its width  $6\frac{1}{2}$ ; depth  $2\frac{3}{4}$ : D. 42; A. 34; C. 11; P. 35. Port Foulke, Greenland. (*Gill.*)

(Gill, Proc. Acad. Nat. Sci. Phila, 1864, 191.)

#### 1135. L. tunicata Reinh.

Yellowish, mottled with brownish. Eye nearly 3 in snout or interorbital space; posterior nostril not tabular; pseudobranchiæ reduced to two lamellæ; vertical fins continuous; anal beginning below tenth dorsal ray; ventral disk longer than broad, half length of head; skin thin, loose. D. 42; A. 34; C. 12; P. 34. Coasts of Greenland. (Günther.)

(Liparis tunicata Reinhardt, Overs, Kong. Danske Vidensk, Selsk, vi, exi, 1836, "D. 39; A. 33; P. 30; C. 14": Liparis fabricii Kröyer, Naturh, Tidsskr, ii, 274, 1847: Liparis fabricii Giinther, iii, 161: Liparis fabricii Gill, Proc. Acad. Nat. Sci. Phila. 1864, 192.)

# 1136. L. lineata (Lepechin) Kröver.

Yellowish, striped with dark brown or purplish; the color very variable. Body thick, covered with thin, loose, slippery skin; head obtuse, the nape swollen; snout broad, not depressed; lips thickish; posterior nostril tubular; eye 7 in head; gill-openings reduced to a vertical slit extending to upper part of root of pectoral; pseudobranchiæ obsolete; tail truncate at base of caudal. Dorsal and anal fins united with the caudal; ventral disk rather longer than broad, half length of head, its margin with about 13 papillæ. Head 4; depth 3½. D. 33; A. 28; P. 34; C. 13. L. 5 inches. Northern Europe and America, south to Cape Cod.

(Cyclopterus liparis L. Syst. Nat. i, 414: Cyclopterus lineatus Lepechin, Nov. Comm. Petropol. xviii, 522: Liparis vulgaris Günther, ii, 159; Lütken, Naturh. Foren. Vidensk. Meddels. 1860 and 1861, 243; Collett, Norges Fiske, 1875, 65.)

#### 1137. L. ranula Goode & Bean.

Color uniform whitish, translucent in life. Body thick, subcylindrical anteriorly, rapidly tapering to the tail; skin thick, lax; snout broad, with prominent vertical profile, its length 4 in head; maxillary 3 in head, not reaching front of orbit; ventral disk nearly round, its length half its distance from snout. Head 4; depth 4. Pectoral 5.

D. about 48; A. about 48; P. 27; V. 14 (papillae). (Goode & Bean.) Halifax

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 46.)

bb. Dorsal separated from candal by a notch.

# 1138. L. montagni (Donov.) Cuv.

Yellowish, the vertical fins brighter, with darker margins. Trunk thick; head broad; skin thin, loose; head flat above the nape, slightly prominent; snout very broad; maxillary not reaching eye; posterior nostrils simple; eye 9 in head, half length of snout or interorbital space; pseudobranchiæ none; posterior nostril not tubular; pectorals notched; dorsal continuous, not joined to the candal; anal not connected with candal; ventral disk circular, not quite half as long as head. Head 4 in total length; depth 5. D. 28; A. 24; C. 14; P. 30; vert. 10 + 25. (Günther.) Massachusetts to Greenland and Northern Europe; not rare.

(Cyclopterus montagui Donovan, British Fishes, iii, pl. 68; Günther, iii, 161: Collett, Norges Fiske, 1875, 67.)

# 1139. L. calliodon (Pallas) Gthr.

Olivaceous, punctate with black dots, light below. Body depressed forwards, compressed and tapering behind; head narrowed forwards; snout rounded; eye small; interorbital space broad and nearly flat; maxillary not reaching eye; teeth small, evidently tricuspid, in broad bands; skin lax, thickish. Gill-openings very small. Dorsal and anal barely joined to base of caudal rays; edge of disk with 12 papilla; diameter of disk about one-half length of head. D. 28; A. 26. Alaska; abundant.

(Cyclop'erus callyodon Pallas, Zoogr. Ross.-Asiat. iii, 75, 1811; Günther, iii, 162.)

## 1140. L. cyclopus Gthr.

Reddish olive, with darker specks, most conspicuous on the fins; a dark bar at base of caudal; a dark streak below eye; a pale streak along sides. Skin not very thick, adherent. Body everywhere compressed, even the head being deeper than broad; head scarcely convex above, the nape not prominent; jaws equal; maxillary reaching to opposite middle of the small eye; teeth small, three-lobed; ventral disk oval, three-fifths length of head. Dorsal fin scarcely emarginate, the spines rather stiff, the first spine in front of vent; pectorals reaching vent; caudal entirely free from dorsal and anal. Head 4; depth 5. D. VII, 23; A. 27; C. 12. Monterey to Puget Sound. (Here described

from a small example taken at Montercy, perhaps belonging to a different species.)

(? Liparis cyclopus\* Günther, ii, 163, 1861.)

aa. Dorsal fin emarginate, the spines separated from the soft rays; skin firm. (Neoliparist Steind.)

#### 1141. L. mucosa Avres.

Rose-red or brownish, unspotted. Body strongly compressed, the back somewhat elevated, not much depressed forwards, the head not wider than deep, longer than in L. pulchella; mouth rather large, terminal, the jaws equal when closed; teeth blumly tricuspid, the band in upper jaw widest; eyes small; skin firm, thick, little movable. Dorsal fin separated into two parts by a deep emargination; second dorsal rather low, entirely free from caudal; anal nearly free from caudal; pectorals moderate; ventral disk oval,  $2\frac{1}{2}$  in head; vent at posterior fourth of pectorals; end of tail truncate. Head  $4\frac{1}{4}$ ; depth about 4. D. VII, 26; A. 26; C. 16; P. 31. L. 6 inches. Coast of California; rare.

(Liparis mucosus Ayres, Proc. Cal. Acad. Nat. Sci. i, 24, 1855: Liparis mucosus Günther, iii, 559; Steindachner, Ichth. Beiträge, iii, 54, 1875.)

# Family CX—CYCLOPTERIDÆ.

(The Lump Suckers.)

Body short and thick, more or less elevated, covered with a thick skin, which is smooth, tubercular, or spinous; head short and thick; suborbital stay present, thin and flattish; mouth small, terminal; jaws with bands of slender teeth; no teeth on vomer or palatines; gill-openings narrow, restricted to the sides, the membranes being broadly joined to the isthmus and shoulder girdle; branchiostegals 6; dorsal fin long, the anterior part of flexible spines, which, in the adult, are sometimes hidden by a fleshy hump, sometimes entirely wanting; soft dorsal small, opposite the anal, and similar to it; caudal fin rounded, free from the dorsal and anal; ventrals thoracic, radimentary, forming the bony center of a sacking-disk; pectorals short, placed low,

<sup>\*</sup>In Dr. Günther's type of *L. cyclopus*, from Esquimault Harbor, the fin-formula is D. 35; A. 30; C. 12; the ventral disk is said to be less than half the length of the head, and the dorsal is said to begin behind the vent. The species is said to agree 'in nearly every respect with *L. vulgaris*" (lineata). Our specimen is much nearer *L. mucosa*.

<sup>†</sup>Steindachner, Ichth. Beiträge, iii, 54, 1875: type Liparis mucosus Ayres. ( $\nu \varepsilon \omega$ , new; Liparis.)

their bases broad and procurrent; pyloric cœca numerous; vertebra-12 + 16, the skeleton feebly ossified. Genera 2; species 4; inhabiting the northern seas of both hemispheres. By means of the adhesive ventral disk these fishes are enabled to attach themselves very firmly to rocks or other objects.

(Discoboli; group Cyclopterina Giinther, iii, 154-158.)

a. Spinous dorsal wanting; skin smooth or nearly so.......Сусцовтениситнуs, 395. aa. Spinous dorsal present, sometimes disappearing with age; skin tuberculate.

Cyclopterus, 396.

## 395 .- CYCLOPTERICHTHYS Steindachner.

(Steindachner, Ichth. Beiträge, x. 14, 1881: type Cyclopterichthys glaber Steind. = Cyclopterus rentricosus Pallas.)

Body short and thick, rounded, covered with thick smooth skin, destitute of bony tubercles (or nearly so?); tail slender, compressed, the body abruptly contracted to its base; head broad, obtuse; month oblique, the lower jaw prominent; teeth rather small, sharp, in two rows anteriorly; pseudobranchiæ large; gills 3½; suborbital connected by a bony stay with the preopercle; gill-opening small, above the base of the pectoral, which is broad and procurrent; ventral disk moderate, fringed. Dorsal short and high, of soft rays only, opposite the short anal, both well separated from the small candal. (zόzλοπτερός, round-finned; iχθότ, fish.)

# 1142. C. ventricosus (Steindachner) J. & G.

Brown, with numerous round dark spots. Head broader than long, the greatest depth a little less than its length; eye small, round, 7 in head, the maxillary extending to below its middle. Head 3; depth  $2\frac{1}{5}$ . D. 9; A. 7; P. 20; C. 11. L. 12 inches. (Steindachner.) Okhotsk Sea, northward.

(Cyclopterus ventricosus Pallas, Spicilegia Zoöl, vii, 15, t. 2, about 1770; (Cotylis?) rentricosus Günther, iii, 498; Cyclopterichthys glaber Steind, Ichth. Beiträge, x, 14, 1881, taf. viii.)

# 1143. C. stelleri (Pallas) J. & G.

Color blackish. Body ovate, smooth; a single series of osseons tubercles along the middle of the back to the origin of the dorsal fin; lower jaw longest; teeth small, unequal; eyes small, high; gill-opening reduced to a round forumen. Dorsal fin commencing on the middle of the back and extending to near the base of caudal; anal ending opposite dorsal. Peter and Paul's Harbor, Bering's Sea. (Pallas.)

(Cyclopterus stelleri Pallas, Zoogr. Ross.-Asiat. iii, 73, 1841; (Cotylis?) stelleri Günther, iii, 499.)

#### 396.—CYCLOPTERUS Linnens.

(Lumpus Cuvier.)

(Artedi; Linnæus, Syst. Nat.: type Cyclopterus lumpus L.)

Spinous dorsal present, sometimes disappearing with age; skin thick, armed with series of bony tubercles; other characters of the genus included above. ( $z\acute{o}z\lambda oz$ , eircular;  $\pi\tau\varepsilon\rho\acute{o}\nu$ , fin; from the circular ventral disk.)

 a. Dorsal spines not disappearing with age; gill-opening a small slit on level of eye; ventral disk large. (Eumicrotremus\* Gill.)

# 1144. C. spinosus Müller.

Color olivaceous, the skin between the plates thickly punctate. Body orbicular, cuboid anteriorly; base of spinous dorsal and body behind vent abruptly compressed; teeth in narrow bands; gill-openings on a level with eye, slightly narrower than orbit. Spinous dorsal not hidden. covered with rough tubercles, similar to those on body, but smaller: width of ventral disk slightly less than its length, and somewhat less than length of head. Body covered with irregular roundish conical plates, varying much in size, some of the larger with a central point, turned backward; all the plates with small tubercles and slender flexible prickles; small plates along bases of all the fins; a series of 6 large plates extending backward from above eye to opposite the interval between dorsals; a series of 5 on each side of middle of interocular space from snout to nape, these increasing much in size posteriorly; a series of 3 along opercular margin; along base of spinous dorsal, a series of 4, not connected with that of interorbital space; a single large plate on each side of the interval between dorsals; two longitudinal series of 4 large plates each, beginning above base of pectorals and behind gillslits, terminating under the space between dorsals; the largest plate on body is immediately behind axil of pectoral; a smaller one below it, and two others between it and origin of anal; two series of smaller plates below eye; many small plates interposed between the series of large ones; very small plates on under side of head and middle of tail; no plates between ventral disk and vent; none in axil of pectorals. Head 3; depth nearly 2. D. VII-I1; A. 10; C. 10. Alaska to Iceland, south

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1864, 190: type Cyclopterus spinosus Miill. ( $\varepsilon \nu \mu \nu \epsilon \rho o \varepsilon$ , very small;  $\tau \rho \tilde{\eta} \mu \alpha$ , aperture, from the small gill-openings.)

to Puget Sound and Maine. Here described from an Alaskan specimen of "C. orbis"

(Müller, Prodr. Zoöl, Dan. ix, 1777; Fabricius, Fauna Grænlandica, 1780, 134; Güather, iii, 157; Cyclopterus orbis Günther, iii, 158, 1861, specimen from Vaucouvers Island.)

aa. Dorsal spines enveloped in a fleshý hump in adult; gill-openings larger; ventral disk small. (Cyclopterus.)

# 1145. C. Intrappers L.—Lump-Sucker; Lump-fish.

Olivaceous, with darker markings; skin punctulate. Head heavy, almost round; interorbital space very wide, flattish; maxillary reaching to or slightly beyond front of eye; gill-openings extending from level of upper margin of eye to opposite middle of base of pectorals; length of gill-opening about equal to base of pectoral, three-fifths length of head, equal to length of ventral disk; a fleshy hump on the back, which, in the adult, covers the spinous dorsal; skin with small tubercles, and about 7 rows of larger spinous plates; a median dorsal row, which divides and forms two series behind the hump; two lateral rows, of which the lower has larger plates; one abdominal row on each side. Head 3¼; depth 2. D. about VII-10; A. 10. North Atlantic; rather common on the coasts of America and Europe.

(Linnens, Syst. Nat.; Günther, iii, 155: Lumpus anglorum Dekay, N. Y. Fanna, Fish. 305.)

# Family CXI—GOBIESOCHDÆ.

Body rather elongate, broad and depressed in front, covered by smooth, naked skin; mouth moderate; upper jaw protractile; teeth usually rather strong, the anterior conical or incisor-like; posterior canines sometimes present; no bony stay from suborbital across cheeks; opercle reduced to a small spine-like projection concealed in the skin, behind angle of the large preopercle; pseudobranchiae small or wanting; gills 3 or 2½; gill-membranes broadly united, free or united to the isthmus; dorsal fin on the posterior part of the body, opposite to the anal and similar to it, both fins without spines; ventral fins wide apart, each with one concealed spine and 4 or 5 soft rays. Between and behind the ventrals is a large sucking-disk, the ventrals usually forming part of it. This sucking-disk, which is different in structure from that of *Cyclopterus* and *Liparis*, is thus described by Dr. Günther:

"The whole disk is exceedingly large, subcircular, longer than broad, its length being (often) one third of the whole length of the fish. The

central portion is formed merely by skin, which is separated from the pelvic or pubic bones by several layers of muscles. The peripheric portion is divided into an anterior and posterior part by a deep notch behind the ventrals. The anterior peripheric portion is formed by the ventral rays, the membrane between them and a broad fringe, which extends anteriorly from one ventral to the other. This fringe is a fold of the skin, containing on one side the rudimentary ventral spine, but no cartilage. The posterior peripheric portion is suspended on each side on the coracoid, the upper bone of which is exceedingly broad, becoming a free, movable plate behind the pectoral. The lower bone of the coracoid is of a triangular form, and supports a very broad fold of the skin, extending from one side to the other, and containing a cartilage which runs through the whole of that fold. Fine processes of the cartilage are continued into the soft striated margin, in which the disk terminates posteriorly. The face of the disk is coated with a thick epidermis, like the sole of the foot in higher animals. The epidermis is divided into many polygonal plates. There are no such plates between the roots of the ventral fins." (Günther, iii, p. 495.) No air-bladder; intestines short; pyloric ecca few or none; skeleton firm; vertebræ 13 to 14 + 13 to 22. Carnivorous fishes of small size, chiefly of the warm seas, usually living among loose stones between tide-marks and clinging to them firmly by means of the adhesive disk. Genera 10; species 25 to 30.

(Gobicsocidæ Günther, iii, 489-515.)

## 397.-GOBIESOX Lacépède.

(Lacépede, Hist. Nat. des Poiss, ii, 595, 1800: type Gobiesox cephalus Lacépède.)

Body anteriorly very broad and depressed, posteriorly slender, covered with tough, smooth skin; head large, rounded in front; mouth terminal, crescent-shaped; lower jaw with a series of strong incisors in front; upper jaw with a narrow band of teeth, those of the anterior series larger; no teeth on vomer or palatines; gills 3; gill-membranes broadly united under the throat, not attached to the isthmus; sucking-disk large, the posterior portion without anterior free margin. Species numerous, all American; mostly tropical. (Gobius; Esox.)

a. Anal fin of 10 to 13 rays, about as long as dorsal. (Caularchus\* Gill.)
 b. Incisors of lower jaw entire.

<sup>\*</sup>Gill. Proc. Acad. Nat. Sci. Phila. 1862, 330: type Lepadogaster reticulatus Grd. (παυλος, stem; αρχος, anus; i. e., anal many-rayed.)

## 1146. G. reticulatus (Grd.) J. & G.

Light olive, everywhere reticulated with brownish orange; middle of upper lip black; a light bar between eyes and across checks; vertical fins dusky; candal with two faint brownish bars near its base. Head nearly as broad as long; mouth wide, its width more than half length of head; onter teeth of upper jaw rather strong, close-set, vertical, conical, or slightly compressed, a narrow band of small, conical teeth behind them; lower jaw with larger teeth, 6 or 8 of the anterior broad, incisor-like, with entire edges, placed nearly horizontally; lateral and posterior teeth small, as in upper jaw; distance from vent to caudal  $2\frac{3}{4}$  in length of body; sucking-disk as broad as long,  $3\frac{1}{2}$  in length. Head  $2\frac{3}{4}$ ; depth  $6\frac{1}{2}$ . D. 13; A. 12; V. I, 4. L. 6 inches. Puget Sound to Montercy; very abundant in rock-pools.

(Lepadogaster reticulatus Grd. Proc. Acad. Nat. Sci. Phila. 1854, 155; Lepadogaster meandricus Grd. U. S. Pac. R. R. Surv. Fish. x, 130; Gobicsox maandricus Günther, iii, 505.)

#### 1147. G. strumosus Cope.

Bluish plumbeous, fins blackish. Head extremely wide, its width  $2\frac{5}{6}$  in total length; this width partly produced by a large fleshy mass extending from end of maxillary to end of interopercle; eye small; profile of head descending abruptly from posterior line of orbits. Superior dental series 12 on each side, externally, but the three median teeth conceal some series of which the second three external teeth are a continuation; inferior teeth, 11 on each side; four median incisors horizontal and subequal; no marked canine. D. 11; A. 10; C. 16; P. 21. (Conc.) Hilton Head, South Carolina.

(Cope, Proc. Acad. Nat. Sci. Phila, 1870, 121.)

bb. Incisors of lower jaw tricuspid.

#### 1128. G. rhessodon Rosa Smith.

Dark olivaceous, usually with three broad yellowish cross-bands above; the first across interorbital space and checks, the second, very wide, across back and front of dorsal fin, the third below middle of dorsal; some or all of these sometimes wanting. Form much as in G. reticulatus; distance from vent to caudal  $2\frac{2}{5}$  in length of body; maxillary extending to below eye; incisors of lower jaw tricuspid, not much declined, about 8 in number; upper teeth essentially as in G. reticulatus. Dorsal a little longer than anal, coterminous with it. Head  $3\frac{1}{4}$ ; depth  $6\frac{1}{2}$ . D. 11; A. 10. L.  $2\frac{1}{2}$  inches. San Diego to the Gulf of California; locally abundant.

(Rosa Smith, Proc. U. S. Nat. Mus. 1881, 140.)

# FAMILY CXIL—BATRACHIDÆ\*

(The Toad-fishes.)

Body generally robust, depressed anteriorly, compressed behind; head large, depressed, its muciferons channels well developed; mouth very large, the teeth generally strong; premaxillaries protractile; gills 3, a slit behind the last; pseudobranchiæ none; gill-openings restricted to the sides, the membranes broadly united to the isthmus; branchiostegals mostly 6; gill-rakers present, moderate; suborbital without bony stay; post-temporal bone simple, undivided; scales small, cycloid, or wanting. Dorsal fins 2, the first of two or three low, stout spines; soft dorsal very long; anal fin similar, but shorter; ventrals rather large, jugu'ar, I, 2 or I, 3; pectorals very broad, the rays branched; pyloric cerca none; tail diphycercal, the caudal fin distinct, rounded. Carnivorous coast fishes, mostly of the warm seas; the young of some or all the species fasten themselves to rocks by means of an adhesive ventral disk, which soon disappears. Genera 5; species about 12.

(Batrachida Günther, iii, 136-177.)

- a. Body naked.

Porichthys, 399.

#### 398 .- BATRACHUS Bloch & Schneider.

(Klein; Bloch & Schneider, Syst. Ichth. 1801, 42; type Gadus tau L.)

Body comparatively short and robust, scaleless; head large, depressed; jaws, vomer, and palatines each with a single series of strong blunt teeth; mandible with an additional external series at symphysis; teeth of upper jaw small; dentary bones forming an acute angle at symphysis; lips fleshy; upper angle of opercle with 2 diverging spines, more or less concealed in the skin; spinous dorsal of 3 stout short spines, the second the longest; no lateral line nor conspicuous pores; young with series of small tufted cirri on back and sides; branchiostegals 6; vertebre 12 + 22. ( $\beta az \rho \dot{a} \chi oz$ , a frog.)

a. Axil of pectoral with a large foramen.

1149. B. tau (Linn.) Cuv. & Val. - Toad-fish; Oyster-fish; Sarpo.

Dusky olive, with black markings confluent on the sides and forming irregular, indistinct bars; belly and under side of head lighter; fins

<sup>\*</sup> Family "114" of the key on page 80.

with black bars, those on dorsal and anal oblique. Teeth in mandible small anteriorly, regularly increasing in size backwards; those on vomes prominent; a broad flap above orbit; tip of maxillary and lower side of mandible with conspicuous cirri; a series of smaller cirri along margin of preopercle; subopercle ending in a long, sharp spine; orbit about equalling interorbital width or length of snout; pectoral with a large foramen in the axil. Head  $2\frac{1}{3}$ ; depth  $4\frac{1}{3}$ . D. 111–27; A. 24. Massachusetts to the West Indies; very abundant.

(Gadus tan Linn, Syst. Nat.; Günther, iii, 167.)

Subsp. pardus Goode & Bean.

Very pale yellowish-brown, thickly covered with round spots of dark brown; those on head smaller; belly with numerons spots, the largest as large as eye; back with many oblong blotches, besides small round spots; fins blotched and banded; otherwise as in *B. tau.* Pensacola, Fla.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 336,)

## 399.—PORICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila, 1854, 141: type Porichthys notatus Grd. = Batrachus porosissimus C. & V.)

Body rather elongate; head not very broad, depressed, the lower jaw projecting; skin naked, with several series of mucous pores; mouth wide, with conical teeth in the jaws, and a canine tooth on each side of the vomer; opercle with a single spine; first dorsal with 2 very small, stout spines; pectoral broad, without foramen in the axil; branchiostegals 6; air-bladder divided into two lateral parts; vertebrae 11 + 31.  $(\pi o \rho o \tau, \rho o re; i \chi \theta b \tau, fish; in allusion to the extraordinary development of the mucous system.)$ 

# 1150. P. porosissimus (Cuv. & Val.) Günther.—Midshipman.

Olive brown above, with coppery reflections, the belly brassy-yellow; sides with irregular broad vertical cross-blotches, most distinct in the young; dorsal grayish, with oblique dark bars; vertical fins sometimes margined with black; pores of lateral lines bead-like, shining silvery; a white space below eye, with a black crescent below it. Head narrowed forwards; opercle developed as a strong spine; maxillary reaching beyond orbit; lower jaw with a single row of about 10 large, recurved teeth, behind which is a patch of small teeth; sides of jaw with a single series of canines similar to those in front, but larger; upper jaw with an irregular series of small teeth; palatines with a single

series of conical teeth: 2 large curved canines on vomer; head with several rows of fringed pores: one row along lower line of operale and subopercle; another along upper edge of cheeks, this branching behind and below the orbit, one branch running forwards below the orbit and around the snout, the other vertically downwards behind the maxillary; a series of fringes behind the lower lip; behind this a series of pores without fringes; a short straight series of pores on each side of vertex; a row of pores along the base of the dorsal fin, curving at front of dorsal, and terminating at upper angle of opercle; a row below this, not reaching base of pectoral; a third row does not reach the base of candal, and is anteriorly strongly curved upwards to base of pectoral; 2 concentric series on the abdomen, the outer extending forwards be-The so-called "shining pores" on the sides tween bases of ventrals. are not pores, but bright round pieces of shiny membrane, showing through a translucent skin; each of the spots has above it a pair of fringed flaps with a small pore between them; the rows of flaps along bases of dorsal and anal fins are without shining spots. Ventrals reaching bases of pectorals, which reach to opposite the sixth anal ray; candal not half length of head; peritoneum black. Head 33; depth 6. D. H-37; A. 33; V. I, 2; P. 18. L. 15 inches. Pacific coast; very abundant from Lower California to Puget Sound; occasionally southward to Panama; also in the West Indies and on the coast of Brazil.

(Batrachus porosissimus C. & V. xii, 501: Porichthys notatus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 141, and in U. S. Pac. R. R. Surv. Fish. 134; Gunther, iii, 176.)

# FAMILY CXIII.—LEPTOSCOPIDÆ.

Body oblong, low, compressed posteriorly, covered with moderate cycloid, imbricated scales; lateral line complete, anteriorly running along side of back, posteriorly median; head oblong, nearly plane above; eyes small, superior, well forward; suborbital bones enlarged, but without "stay"; nostrils double; opercle fringed; mouth nearly vertical; premaxillaries protractile, not forming the entire edge of the upper jaw; lips fringed; gill-openings very broad, the membranes separate and free from the isthmus; pseudobranchiae present or absent. Dorsal fin very long, undivided, several of the anterior rays spinous; anal very long, commencing close behind the vent, which is near the breast; caudal diphycercal, free from dorsal and anal; pectorals variable, the base procurrent; ventrals jugular, I, 3 or I, 5; vertebræ more than 10 + 14; pyloric cæca none. Genera about 5; species about 10;

inhabiting the tropical seas. This group or family is most nearly related to the *Uranoscopida*, but some of the species show *Blennioid* traits.

(Leptoscopoidæ Gill, Proc. Acad. Nat. Sci. Phila, 1862, 503-506.)

- a. Ventral rays I, 3; pectoral rays simple. (Dactyloscopina.)
  - b. Pseudobranchia none; head cuboid; dorsal commencing at the nape.

DACTYLOSCOPUS, 400.

## 400.-DACTYLOSCOPUS Gill.

(Gill, Proc. Acad, Nat. Sci. Phila, 1859, 132: type Dactyloscopus tridigitatus Gill,)

Body moderately elongate, covered with rather large, cycloid scales; head euboid, oblong and nearly flat above; eyes small; interorbital space broad; mouth nearly vertical; lower jaw not dilated beneath nor emarginate in front, without barbels; no intralabial filament; teeth villiform, on jaws only; pseudobranchiæ obsolete. Dorsal commencing at the nape, with 10-12 spines; ventral rays I, 3. (δαατολος, finger; σχοπος, short for *Uranoscopus*.)

# 1151. D. tridigitatus Gill.

Whitish; head with coarse wavy darker lines; fins immaculate. Body slender, much compressed posteriorly; opercular fringe of 15 separate filaments. Distance from snout to dorsal 5 in total length of body. Head 5 (in total); depth 7. D. XII, 28; A. II, 32; P. 13; V. I, 3; scales 11 + 4 + 30 = 45. West Indies, north to Key West. (Gill.) (Gill, Proc. Acad. Nat. Sci. Phila. 1859, 132, 1861, 264, and 1862, 505; Günther, iii, 279.)

# FAMILY CXIV.—BLENNIIDÆ.\*

# · (The Blennies.)

Body oblong or variously elongate, usually compressed; naked, or covered with usually cycloid scales; teeth usually well developed; suborbital ring not articulated with the preopercle; dorsal fin long, continuous, or divided into two or three fins, the anterior portion and sometimes the whole fin composed of spines, which are stiff or flexible; anal fin long, usually with one or two small spines; ventrals jugnlar, fewrayed, or wanting; caudal fin present, rounded; tail diphycercal; airbladder usually wanting; pseudobranchiæ present; gills 4, a stit behind the fourth; vertebræ numerous. Genera about 50; species nearly 300. As here understood, a large and varied family, chiefly of small carnivorous fishes, inhabiting rock-pools and sea bottoms near the shor Some of them are found in the fresh-water lakes of Italy. Map

<sup>\*</sup>Including families 112 Blennida and 113 Anarchichadida of the key on and 81.

them (Clininæ) are ovoviviparous. Professor Gill divides this group into several families (Anarrhichadidæ, Blenniidæ, Cebedichthyidæ, Xiphidiontidæ, Stichæidæ, and Cryptacanthidæ, but the second, third, fourth, and fifth of these groups at least are very closely allied. Genera about 40: species about 250.

(Blenniidæ pt. Günther, iii, 206-294.)

- \* Molar teeth none.
- a. Teeth long and slender, curved, hook-like or comb-like; in front of jaws only;
  body naked; dorsal with many soft rays;
  ventral fins well developed. Species
  carnivorous, oviparous, chiefly tropical.
  (Blenniinæ.)

  - bb. Anterior teeth comb-like, equal; teeth all fixed.
    - c. Gill-membranes broadly united to the isthmus, the gill-openings restricted to the sides.
      - - ce. Canine teeth present in one or both jaws posteriorly.

Hypleurochilus, 404.

cc. Gill-membranes free from the isthmus, or at least forming a fold across it; posterior canines present.. Blennus, 405.

aa. Teeth conic, not comb-like.

f. Body scaly.

- g. Lateral line present (or more or less obsolete), single, high in front,
  abruptly eurved above pectorals, becoming median posteriorly; dorsal fin with
  one or more soft rays; gill-membranes
  free from isthmus; ventrals well developed. Species carnivorous, ovoviviparous, chiefly tropical. (Cliniuæ.)
  - h. Soft dorsal of numerous rays; scales small.
    - i. Maxillary greatly developed, reaching far beyond eye; teeth on yomer and palatines.....Neoclinus, 406.
    - ii. Maxillary moderate.

      - ii. Air-bladder large; caudal forked; teeth on palatines.

HETEROSTICHUS, 408.

hh. Soft dorsal of a single ray; scales rather large; a notch behind third spine of dorsal.

CREMNOBATES, 409.

- gg. Lateral line, if present, straight, concurrent with the back; sometimes branched or duplicated.
  - k. Mouth horizontal or nearly so.
    - l. Gill-openings not continued forward below, the membranes broadly united, free from isthmus or not; ventral fins very small or wanting. Species carnivorous or herbivorous; oviparous (?) Arctic or subarctic. (Xiphistering.)

m. Dorsal fin of spines only.

n. Lateral line none.

pp. Anal fin with 2 small spines; ventral fins rudi-

mentary......MUR.ENOIDES, 411.

ppp. Anal fin with a large spine in a sheath; ventrals

wanting.......Apodicuturys, 412.

oo. Gill-membranes joined to the isthmus; no ventral fins; no anal spines; pyloric coca.

Anoplarchus, 413.

nn. Lateral lines several; pyloric coca present; gillmembranes free from isthmus; ventrals none; anal spines small.

XIPHISTER, 414.

mm. Dorsal fin with its posterior half composed of soft rays; gill-membranes broadly united, free from isthmus; ventrals wanting; lateral line single, high; pyloric coea present

CEBEDICHTHYS, 415.

U. Gill-openings prolonged forward below, separated by a narrow isthmus; pectorals nearly as long as head; ventrals well developed. Oviparous, herbivorous. Arctic. (Stichwing.)

q. Lateral line present.

0

r. Lateral line forked or duplicated.

Eumesogrammus, 416.

rr. Lateral line simple, median...STICHEUS, 417. rrr. Lateral line simple, dorsal.

Notogrammus, 418.

qq. Lateral line obsolete,

s. Teeth on vomer or palatines. Lumpenus, 419.

88. Teeth on jaws only.... Leptoblennius, 420.

ff. Body naked; dorsal fins of spines only; ventrals obsolete.

t. Gill-membranes joined to the isthmus; lateral line obsolete; pyloric ecca present; mouth nearly vertical; teeth strong, on jaws, vomer, and palatines.

CRYPTACANTHODES, 422.

aa. Molar teeth strong, on vomer, palatines, and sides of lower jaw; dorsal of flexible spines only; scales minute; gill-membranes joined to the isthmus; no ventral fins; air-bladder present; no lateral line. (Anarrhichadine.)

Anarrhichthys, 424.

### 401.—OPHIORLENNIUS Gill.

(Blennophis Valenciennes; preoccupied.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1860, 103: type Blennophis webbii Val.)

Body moderately elongate, strongly compressed, scaleless; snout short, high, abruptly decurved anteriorly; symphysis of lower jaw with 4 hooked canines, the outer strongest and bent backward, almost forming a right angle; sides of lower jaw with 2 or 3 still larger canines, the hindmost very large and bent backward; upper jaw with 4 slender canines in front, followed by a long row of shorter, slender, movable teeth, which are set close together; nasal tentacle digitate; a low simple tentacle above eye; gill-openings wide. Dorsal fin long, the spines slender, separated by a slight notch from the soft rays; caudal lunate, free from dorsal and anal; ventrals moderate, I, 2; pectorals large. ( $\delta \varphi \iota \varsigma$ , snake; Blennius.)

# 1152. O. webbi (Val.) J. & G.

Dark golden-brown, sometimes with a broad cross-band of dusky violet on back and dorsal fin; caudal with 2 dark longitudinal stripes; dorsal and anal purplish or orange; an intense, round, dark, ocellated spot behind eye. Head much compressed; eye 3½ in head; snout 4½. Dorsal beginning above gill-opening, ending just before caudal; its soft rays somewhat higher than the spines, the highest spine 1½ in head; caudal and pectorals each about as long as head; ventrals 1½ in head. Head 4; depth 4½. D. XI-22; A. II, 23; V. I, 2; P. 15. "Western coast of Southern California" to Mazatlan, Barbadoes, and Canary Islands. (Steindachner.)

(Blennophis webbii Valenciennes; Webb & Berthelot, Hes Canar. Poiss. 60: Blennophis webbi Günther, iii, 259; Steindachner, Ichth. Beiträge, viii, 41, 1879.)

### 402.-CHASMODES Cuvier & Valenciennes.

(Cuv. & Val. Hist. Nat. Poiss. xi, 295, 1836: type Blennius bosquianus Lac.)

Body oblong, compressed, naked; head triangular in profile, the snout somewhat pointed; mouth large, with lateral cleft, the maxillary usually extending to beyond eye; premaxillaries not protractile; teeth in a single series, long and slender, comb-like, confined to the front of each jaw; no eanines; cirri very small or wanting; gill-openings very small, their lower edge above the middle of the base of the pectorals; lateral line incomplete. Fins as in *Blennius*. American. (χασμώδες, yawning.) (See Addenda.)

# 1153. C. bosquianus (Lac.) Cuv. & Val.

Color (in 3) olive green, with about nine horizontal narrow blue lines,

these somewhat irregular and interrupted, converging backwards; opercular membrane and a broad stripe through middle of spinous dorsal deep orange-yellow; anal fin dark, the rays with white membraneceous tips; \$\forall \text{dark olive green, reticulated with narrow pale green lines, and with several broad dark bars, which are more distinct posteriorly; vertical fins similarly marked; head finely dotted with black; a dusky spot at base of candal in both sexes. Orbital tentacle very minute or wanting; maxillary extending to rather beyond eye; interocular space very narrow, not concave. Dorsal fin not emarginate, the spines slender. Dorsal joined to base of caudal; anal free. Head 3\frac{1}{2}; depth 3\frac{1}{2}\$. D. XI, 19; A. 20. New York to Florida; chiefly southward.

(Blennius bosquianus Lac. Hist. Nat. Poiss. ii, 493, 1800 (\$\rho\$); Günther, iii, 229: Pholis novemlineatus Wood, Journ. Acad. Nat. Sci. Phila. iv, 280, 1824 (\$\zeta\$): Chasmodes novemlineatus Günther, iii, 229.)

# 1154. C. quadrifasciatus (Wood) C. & V.

Body with 4 distinct brownish bands, a fifth broader and less marked on the neck; four round yellowish spots along base of anal; head spotted with blackish. Lower jaw slightly longer than the upper. Dorsal fin free from the caudal; anal fin highest anteriorly. D. 27; A. 15. (Wood.) Habitat uncertain, probably South Atlantic coast of the United States.

(Pholis quadrifasciatus Wood, Journ. Acad. Nat. Sci. Phila. iv, 282, I824; Günther, iii, 229.)

### 403 .- ISESTHES Jordan & Gilbert.

(Gen. nov.: type Blennius gentilis Girard.)

This genus differs from *Blennius* in the absence of canine teeth and in the restriction of the gill-openings to the sides, the gill-membranes being fully united to the isthmus as far as the base of the pectorals. The known species are American. ( $i\sigma\sigma\xi$ , equal;  $\varepsilon\sigma\thetai\omega$ , to eat; in allusion to the uniformity of the teeth.) (See Addenda.)

# 1155. I. gentilis (Grd.) J. & G.

Olivaceous, body and fins marbled and spotted with darker; aval pale-edged; a blue spot on the dorsal in front; males with golden stripes on lower parts of head. Gill-openings extending downward to lower edge of pectorals. Head large, short and blunt, the profile of snout steep; supraorbital cirrus large, multifid, as high as eye; interorbital space convex, less than half width of orbit; no canines. Dorsal fin not emarginate, free from caudal, its spines stiff, lower than soft rays,  $2\frac{1}{2}$  in head; pectorals reaching anal; ventrals half way to vent;

lateral line present anteriorly, ending above anal. Head 3½; depth 4. D. XII, 19; A. 21; P. 14. L. 5 inches. Coast of California, from Point Concepcion southward.

(Blennius gentilis Girard, Proc. Acad. Nat. Sci. Phila. 1854, 149: Blennius gentilis Günther, iii, 217: Blennius gentilis Steindachner, 1chth. Beiträge, v, 150, 1876.)

# 1156. I. punctatus (Wood) J. & G.

Light olivaceous, with darker reticulations, forming ill-defined vertical bars; head with very distinct black dots; a series of black dots on each side of lateral line; dorsal with a black blotch in front and with the lateral bars extending on it; anal fin blackish, the rays tipped with white; caudal barred. Body rather deep; head large, obtuse; interorbital space concave, half the diameter of orbit; orbital cirrus as long as dorsal spines, bifid at tip, branched below; a minute nasal cirrus; no canines; gill-openings extending to about lower fourth of base of pectoral, thus narrower than in I. gentilis. Dorsal fin high, little notched, the soft part highest, the spines stiff,  $2\frac{2}{3}$  in head. Head  $3\frac{2}{5}$ ; depth  $3\frac{1}{2}$ . D. XII, 15; A. 19. Coast of North and South Carolina.

(Blennius punctatus Wood, Journ. Acad. Nat. Sci. Phila. iv, 278, 1825: Blennius punctatus Günther, iii, 228: Blennius heutz Le Sueur, Journ. Acad. Nat. Sci. Phila. iv, 363, 1825: Hypsoblemius hentzi Gill, Cat. Fish. East Coast N. Amer. 1861, nomen nudum.)

#### 401.—HYPLEUROCHILUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila, 1861, 168; type Blennius multifilis Grd.)

This genus differs from *Blennius* in the restriction of the gill-openings to the sides, the gill-membranes being broadly and fully joined to the isthmus. (5, upsilon;  $\pi \lambda z \tilde{\nu} \rho \omega v$ , side;  $\chi z \tilde{\iota} \lambda \omega z$ , lip; the allusion not evident.)

### 1857. II. multifilis (Grd.) Gill.

?

Dusky brown, back and vertical fins with roundish spots, most conspicuous in the young. Head short, the profile bluntly decurved; maxillary reaching to below middle of eye; four canine teeth, those in the lower jaw larger than those in upper; supraocular cirri very high, each with four smaller ones at base. Dorsal fin not emarginate, the soft rays rather higher than the slender flexible spines; membrane of last ray almost reaching base of candal; origin of anal in advance of that of soft dorsal; pectorals broad, reaching beyond front of anal; ventrals long, nearly reaching vent. Head  $3\frac{3}{4}$ ; depth about same. D. XIII, 14; A. II, 18; V. I, 3. Coast of Texas. (*Grd.*)

(Blennius multifilis Girard, U. S. Mex. Bound. Surv. 1859, 27, pl. xii, f. 6: Blennius multifilis Günther, iii, 562; Gill, Proc. Acad. Nat. Sci. Phila. 1861, 168.)

# 1158. H. geminatus (Wood) J. & G.

Olive brown, faintly barred with darker; sides plain (in our specimens), or with "several pairs of spots of a reddish-brown color, arranged pretty regularly in a double row" (Wood); vertical fins edged with darker, especially the anal; dorsal black in front. Head not very blunt, the anterior profile straight, oblique; orbital cirrus not large, shorter than eye, branched at tip; interorbital space concave, not half diameter of eye; a slight transverse groove behind eye; canines in both jaws very strong, hooked backwards, the lower considerably stronger than upper; gill-openings extending downward to opposite or slightly below lower edge of pectoral. Dorsal fin not emarginate, the spines slender, but rather stiff, lower than the soft rays; pectorals shortish, ventrals rather long. Head 3\frac{1}{3}; depth 4. D. Xl, 15; A. 18. L. 2\frac{1}{2} inches. South Atlantic coast of the United States; abundant in empty shells and clusters of funicates.

(Blennius geminatus Wood, Journ. Acad. Nat. Sci. Phila. iv, 278, 1824: ? Blennius geminatus Günther, iii, 228.)

### 405.—BLENNIUS Linnæus.

### Blennies.

(Artedi; Linnaus, Syst. Nat.: type Blennius ocellaris L.)

- Body oblong, compressed, naked; head short, the profile usually bluntly rounded; month small, horizontal, with a single series of long, slender, curved, close-set teeth in each jaw, besides which, in the lower jaw at least, is a fang-like canine tooth on each side; premaxillaries not protractile; gill-openings wide, extending forward below, the membranes free from the isthmus, or at least forming a fold across it. Dorsal fin entire, or more or less emarginate, usually free from caudal, the spines slender; pectorals moderate; ventrals well developed, I, 3; no pyloric cœca; lateral line developed anteriorly. Species very numerous, lurking under rocks and algae in all warm seas; some species in the lakes of Northern Italy. (Blennius, the ancient name, from βλεννα, slime.)
- a. Orbital cirri present. (Blennius.)
  - b. Both jaws with canine teeth.
    - c. Dorsal little emarginate.

### 1159. B. fucorum Cuv. & Val.

Olive green, becoming darker above, with numerous brown spots on the cheeks and sides of the body; below faintly reddish. Orbital cirri nearly as long as head, bifid above, and with fringes at the base. Dorsal fin slightly emarginate, free from the caudal, the spines rather stiff. Head very short and deep, its profile nearly vertical; both jaws with very strong canines. Gill-membranes free from isthmus posteriorly. Head 5 in total length. D. XI, 17; A. 18. Open ocean, from near the Azores; said to have been once taken off the coast of New York.

(Cuvier & Valenciennes, xi, 263; Günther, iii, 217; Dekay, New York Fauna, Fish. 149, pl. 22, fig. 66.)

aa. Orbital cirri none. (Pholis\* Fleming.).

# 1160. B. carolinus (C. & V.) J. & G.

Greenish, with 4 or 5 irregular dark spots or shades along the back; dorsal with a large black spot in front; anal brown-edged. Body rather long and slender, more elongate than in *Blennius pholis*, more compressed, the head longer; maxillary extending to opposite middle of eye; teeth  $\frac{1.6}{1.4}$ , with strong canines in both jaws. Gill-membranes free from isthmus; no trace of tentacles above eye. Dorsal spines slender, a little lower than the soft rays, the fin little emarginate; dorsal and anal not joined to the caudal. D. XII, 18; A. 17. South Carolina. Only the original type in the museum at Paris known; from this the present description was taken.

(Pholis carolinus Cuv. & Val. xi, 276.)

#### 403.-NEOCLINUS Girard.

(Girard, U. S. Pac. R. R. Surv. Fish. x, 114, 1858: type Neoclinus blanchardi Girard.)

Body compressed, rather elongate, covered with minute cycloid scales; lateral line present, incomplete, high anteriorly; head naked, the cheeks tumid; upper jaw protractile; maxillary greatly produced backward, more than two-thirds length of head, reaching far beyond the eye; both jaws, vomer, and palatines with stout, unequal, conical teeth in a single series, besides which, in the front of the jaws, are smaller teeth; nasal and supraocular region with fringed tentacles; gill-membranes broadly united, free from the isthmus; gill-rakers weak. Dorsal fin long, scarcely emarginate, its anterior two-thirds composed of slender, flexible spines, which are similar to the soft rays, all of which are simple; anal long, its rays all simple; ventrals moderate, I, 3; caudal fin distinct; pectorals rather broad, rounded; no air-bladder; no pyloric coca. Pacific Ocean. (véos, new; zhívos, Clinus.)

<sup>\*</sup> Fleming, Brit. Anim. 207: type Blennius pholis L.  $(\theta \circ \lambda)$ 's, ancient name of some fish which was believed to shelter itself in a cloud of mucous which it produced.)

#### 1161. N. satirious Girard.

Dark brown, nearly uniform; maxillary flap broadly edged with bright yellow. Head bluntish, convex in profile; eyes large, high up, well forward, separated by a rather narrow flattish interorbital space; top of head convex; checks long; opercles short. Head larger, and teeth rather stronger than in *N. blanchardi*; maxillary enormously developed, reaching about to gill-opening, its length varying with age; provided at tip and inner margin with a very broad wing-like flap, which is joined to the lower part of the check; this membrane is more than twice the diameter of the eye; below it is another membrane connecting this with the lower jaw; supraorbital cirrus quite small, but present. Head 3½; depth 6; maxillary with flap, 3½. D. 43; A. 29. L. 12 inches. Monterey, Cal.; a rare and most interesting species.

(Neoclinus satiricus Girard, Proc. Acad. Nat. Sci. 1859, 57; Günther, ii, 260.)

# 1162. N. blanchardi Girard.

Dark red or plum color, with olive-green blotches on the side; belly olive, speckled with lighter; front of mouth red; fins colored like the body; a black spot occllated with yellow between the first and second dorsal spines; 2 light-yellow spots at base of caudal; dorsal and caudal tinged behind with yellow; anal and pectorals chiefly vermilion; color quite variable, some specimens duller or barred. A long cirrus, much longer than eye, above the front of the eye; reddish at base, its fringed tips bright yellow; a short, multifid, nasal barbel, and a cluster of 3 or 4 fringed barbels behind supraocular cirrus. Maxillary two-thirds length of head, 6 in body, large, reaching nearly to opposite front of dorsal; lateral line ending opposite the vent, only its straight anterior portion being developed. Dorsal spines one-third length of head. Head 4; depth 5. D. XXVI, 17; A. 30. Coast of California, north to Monterey.

(Girard, U. S. Pac. R. R. Surv. Fish. 1858, 114; Günther, ii, 259.)

#### 407.-CLINUS Cuvier.

(Cuvier, Règne Anim. ii, 1817: type Clinus acuminatus C. & V.)

Body more or less clongate and compressed, covered with small or minute scales, which are usually cycloid; lateral line complete, abruptly decurved behind the pectoral; head obtuse or somewhat pointed; stout, unequal, conical teeth on jaws and vomer, and sometimes on palatines; the teeth mostly in single series, except in front; no conspicuous posterior canines; maxillary not produced backward from angle of mouth; gill-membranes united, free from the isthmus. Dorsal fin long and low, chiefly composed of spines; some of the anterior spines often different from the others, longer or shorter, and set farther apart; anal fin low, with 2 spines; ventral fins jugular, of 1 spine and 2 or 3 rays; candal fin truncate; branchiostegals 6; airbladder and pyloric cœca absent; viviparous. Inhabiting rock-pools among algæ, in warm seas. Our two species are very different, and represent opposite extremes in this large and varied genus. (zλίνος, a name of some sleepy fish; from zλίνη, a bed.)

a. Nape with a fringe of filaments; teeth on vomer and palatines; scales moderate. (Labrosomus\* Swainson.)

# 1163. C. nuchipimnis Quoy & Gaimard.

Reddish brown, sometimes with vertical bands; a black spot on opercle, which is often edged with white; cheeks and fins reticulate or dotted. Body oblong, rather robust; head naked, thick, short, not very obtuse anteriorly, compressed above; mouth rather large, the maxillaries not prolonged backward, extending to opposite the posterior part of eye, 23 in head; teeth on jaws, vomer, and palatines; front teeth of jaws conic, strong; eyes large; interorbital space very narrow; each side of neck with a long series of hair-like filaments, nearly as long as eve; orbital tentacle short and broad, multifid; nostrils with a tufted barbel; lower jaw slightly projecting, its posterior teeth sometimes recurved; pectorals a little shorter than head, reaching vent. Dorsal spines rather slender, the three anterior spines scarcely shorter than the others; all the spines lower than the soft rays; dorsal fin commencing near the nape, the spinous portion long; soft rays higher than the spines; caudal small; pectorals rather large; ventrals moderate; gill-membranes broadly united; free from the isthmus; lateral line complete, high anteriorly, then abruptly decurved; membranes of vertical fins scaly; scales not very small, eyeloid. Head 31; depth D. XVIII, 12; A. II, 17; Lat. 1. 70. L. 8 inches. West Indies; occasional on our South Atlantic coast.

(Clinus nuchipinnis Quoy & Gaimard, Voy. Urania Zoöl. 255: Clinus pectinifer Cnv. & Val. xi, 374: Lepisoma cirrhosum Dekay, N. Y. Fanna, Fish. 1842, 41: Clinus nuchipinnis Günther, iii, 262: Labrosomus pectinifer Gill, Proc. Acad. Nat. Sci. Phila. 1860, 105.)

<sup>\*</sup>Swainson, Class. Fish. ii, 75, 1839: type Clinus pectinifer Cuv. & Val. = Clinus nuchipinnis J. & G. (Labrus;  $\sigma \tilde{\omega} \mu \alpha$ , body.)

aa. Nape without fringe of filaments.

 b. Head pointed; no palatine teeth; spinous dorsal notched behind fifth spine; scales minute. (Gibbonsia \* Cooper.)

### 1164. C. evides J. & G. nom. sp. nov.

Usual color of adult translucent, reddish or orange, nearly plain: a large pellucid spot on the membrane behind third dorsal spine, and some small ones behind it; pectorals barred; young specimens variously variegated, with light and dark shades of red, brown, and white, the hue varying exceedingly and dependent on the surroundings; a dark spot usually present behind gill-opening. Body elongate, compressed: head small, rather pointed; mouth quite small, terminal, the maxillary about reaching pupil, 31 in head; lower jaw projecting; no teeth on palatines; posterior teeth not recurved; eye moderate, shorter than snout, nearly 6 in head; a small supraocular flap, not higher than First spine of dorsal inserted over preopercle, its length more than one-third that of head; the second nearly equal; the third, fourth, and fifth progressively shorter; the sixth about as long as fourth; the seventh longer; the rest nearly equal to the last, which is lower than the soft rays; pectorals short, not reaching vent; ventrals short; scales very small, smooth; head naked; no air-bladder. Head  $4\frac{2}{3}$ ; depth  $4\frac{2}{3}$ . D. V, XXXI, 10; A. II, 26. L. 9 inches. Coast of California, from Monterey southward; in rock-pools; very abundant.

(Mysodes (Gibbonsia) elegans Cooper, Proc. Cal. Acad. Nat. Sci. iii, 109, 1864: Blakea elegans Steindachner, Ichth. Beiträge, v, 148, 1876; not Clinus elegans C. & V.)

### 408.—HETEROSTICHUS Girard.

# Kelp-fishes.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 143: type Heterostichus rostratus Grd.)

Body rather elongate, compressed, covered with very small, smooth scales; head long and low, the snout conic, produced, very acute; premaxillaries protractile; mouth moderate, terminal; each jaw with a row of conical teeth, behind which anteriorly is a broad patch of villiform teeth; vomer and palatines with villiform teeth; gill-rakers feeble; gill-membranes broadly united, free from the isthmus; orbital cirri minute or wanting; cheeks scaly. Dorsal fin very long, the posterior rays soft, the five anterior spines wider apart than the rest and separated from them by a notch, the first and second spines longest, rather flexible, the other spines stiff; caudal fin forked; ventrals I, 3; pec-

<sup>\*</sup>Cooper, Proc. Cal. Acad. Nat. Sci. iii, 109: type Myxodes elegans Cooper. (Dedicated to Dr. J. P. Gibbons.)

torals moderate; lateral line simple, complete, abruptly curved behind pectorals; air-bladder present, large. Size large. (ξτερος, different; στίγος, rank; in allusion to the anterior dorsal spines.)

# 1165. H. rostratus Grd.—Kelp-fish.

Translucent reddish brown, varying to blackish or olive, with traces of shining pale bands on the sides, and dark vertical bars, the hue and pattern of color varying greatly; young specimens most variegated; a translucent spot behind third dorsal spine. Body much compressed, deepest anteriorly; head slender, compressed and pointed; lower jaw projecting, with thick lip; maxillary reaching pupil,  $2\frac{2}{3}$  in head; eye large, 7 in head; orbital cirrus minute, usually entirely wanting; cheeks and upper edge of opercle with small scales, rest of head naked; middle rays of caudal about two-thirds length of outer. Head  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$ ; B. 6. D. V, XXXII, 13; A. II, 34. L. 15 inches. San Francisco to San Diego. The largest of the *Blennies* which are allied to *Clinus*.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 143; Girard, U. S. Pac. R. R. Surv. Fish. 36; Günther, ii, 264, and iii, 261.)

#### 409.—CREMNOBATES Günther.

Auchenopterus Günther, preoccupied.)

(Günther, Proc. Zoöl Soc. Lond. 1861, 374: type Auchenopterus monophthalmus Gthr.)

Body moderately elongate, compressed, covered with rather large cycloid scales; head shortish, naked; checks full; mouth moderate, with a band of conical teeth in the jaws and about one series on the vomer; none on the palatines; gill-membranes united, free from the isthmus; upper surface of head with tentacles. Dorsal fin low, composed of stiff spines, with but a single soft ray, which is lower than the spines; first three spines more or less separated from the others; anal fin low, with two spines; ventrals jugular, well developed; pectorals broad; lateral line complete, strongly curved anteriorly. Warm seas. This genus differs from *Cristiceps* in having but one soft ray in the dorsal fin, and in the well-developed scales. (χρημνοβάτης, one who haunts rocks.)

a. Three anterior spines connected to the others by membrane.

### 1166. C. integripinnis Rosa Smith.

Color dark brown, variegated with different shades of brown and

reddish; about 5 indistinct dark cross-bars; a distinct occllated black spot on posterior part of dorsal fin; caudal fin translucent, speckled; a black bar at its base; base of pectorals violet, bordered with black, the rest of the fin checkered; ventrals barred. Head stout, broad, conical; mouth little oblique; eyes large; nasal, supraocular and nuchal regions with fringed cirri, those at the nape flap-like. First and second dorsal spines low, a little higher than the third, which, in turn, is higher than the fourth, and separated from it by an interspace; the membrane between the third and fourth spines deeply emarginate; anterior spines not forming a separate fin; highest anterior spine not higher than the highest of the posterior part of fin. Head 4; depth  $4\frac{1}{3}$ . D. III, XXVIII, 1; A. II, 20; V. I, 3; Lat. 1. 38. L.  $2\frac{1}{2}$  inches. San Diego, California, southward to Mazatlan; abundant in rock-pools.

(Cremnobates integripinnis Rosa Smith, Proc. U. S. Nat. Mus. 1880, 147.)

### 410.—CHIROLOPHUS Swainson.

(Blenniops Nilsson: Carelophus Kröyer.)

(Chirolophis Swainson, Class. Fish. ii, 275, 1839: type Blennius yarrelli C. & V. = Blennius ascanii Walb.)

Body moderately elongate, covered with small scales; no lateral line; snout short; no teeth on vomer or palatines; teeth in jaws small; gill-membranes united, free from the isthmus; nostrils, orbital region, and neck with dermal flaps, the supraorbital flaps high. Dorsal fin long, of spines only; ventrals well-developed, jugular; caudal fin distinct. No air-bladder or pyloric ecca. Northern seas; one species known from Europe; a second species, imperfectly described by Pallas, may be provisionally placed with it. (χείρ, hand; λοφος, crest; apparently zaρa, head, was intended, which would make "Carelophus.")

# 1167. C. (?) polyactocephalus (Pallas) J. & G.

Form of Zoarces. Body compressed, covered with soft imbedded scales; head very short, retuse; lower jaw longer; "both jaws without teeth"; (?) eyes approximate; interorbital space with 2 minute cartilaginous spinules; 2 large superciliary cirri; vertex behind orbits subexcavated, with 2 series of erect cirri. Dorsal fin beginning at the neck, extending to the caudal; ventrals undescribed. D. LXX. Kamtschatka (Pallas) and Alaska.

(Blennius polyactocephalus Pallas, Zoöl. Ross.-Asiat. iii, 179, 1811.)

# 411.-MURÆNOIDES\* Lacépède.

# Butter-fishes.

(Centronotus Bloch: Gunnellus Cuvier.)

(Lacépède, Hist. Nat. Poiss. ii, 324, 1800: type Muranoides sujef Lacép. = Blennius gunnellus L.)

Body long and low, considerably compressed, somewhat band-shaped, the tail slowly tapering; head small, compressed, naked or scaly; mouth rather small, oblique; jaws with rather small teeth in narrow bands or single series; vomer and palatines usually toothless; gillmembranes broadly united, free from the isthmus; scales very small,

### M. tania (Pallas).

Body banded; teeth obtuse, subdistinct; head subtriangular, compressed; body ensiform, covered with minute imbedded scales; vent median. Dorsal fin extending from near the head to the tail, the spines subequal; candal subdistinct; pectorals small; ventrals represented by 2 recurved spines. D. LXXXVII; A. 47. Kurile Islands. (Pallas.)

(Blennius tania Pallas, Zoogr. Ross.-Asiat. iii, 178.)

### M. ruberrimus (Cuv. & Val.)

Bright red. Form of preceding; scales inconspicuous; ventrals each a single scarcely projecting spine; caudal broad, rounded, distinct. D. CXV. Kurile Islands. (*Pallas.*)

(Gunnellus ruberrimus Cny. & Val. xiv, 440, after Pallas, l. c. 178.)

### M.? occilatus (Tilesius.)

Brownish, marked with yellow and purple; six black ocellated spots along the dorsal fin. Candal distinct; ventrals none. D. LXXX; A. 50. Otherwise essentially as in M. gunnellus. Kamtschatka. (Cur. & Val.)

(Ophidium occilatum Tiles. Mém. Acad. St. Petersb. ii, 237, 1811: Gunnellus apos Cuv. & Val. xiv, 426: Centronotus apus Gthr. iii, 288.)

#### GUNNELLOPS Bleeker.

#### (Blecker: type Blennius roseus Pallas.)

Apparently distinguished from Muranoides by the tapering tail, around which the vertical fins are confluent; palatine teeth present.

(Gunnellus, Gunnel, an old name of Muranoides gunnellus; ωψ, eye.)

#### G. roscus (Pallas) Blecker.

Intensely red. Head obtuse, the lower jaw projecting; eyes large; body very long, compressed, tapering into a slender tail; pectorals small, ovate, hyaline; 2 spines in place of ventrals; dorsal extending from the nape to the end of the tail; anal joined to caudal. D. ca. 100; A. ca. 90; P. 9; V. I. Kurile Islands.

(Blennius roseus Pallas, 1. c. 177: Centronotus roseus Gunther, iii, 290.)

<sup>\*</sup> Little known species related to Muranoides, recorded from Kamtschatka, and doubtless occurring also in Alaska, are the following:

smooth; no lateral line. Dorsal fin long and low, beginning near the head, composed entirely of stiff, sharp, subequal spines; anal similar in form, of two spines and many soft rays; caudal fin short and small, sometimes joined to dorsal and anal; pectorals short; ventrals very small, of one spine and a rudimentary ray (obsolete or wanting in some imperfectly-known species provisionally referred to this genus); intestinal canal short, without cœca. Shore fishes of the Northern fishes of the Northern seas. (μυρανία, an eel; είδος, form.)

b. Ventrals present, I. 1. (Muranoides.)

# 1168. M. gunnellus (L.) Gill.—Butter-fish.

Olive brown; sides with numerous obscure darker bars; base of dorsal with occilated dark spots; a dark bar below eye. Head short and compressed, scaleless; mouth oblique; maxillary reaching front of pupil; caudal fin distinct; pectorals little more than half length of head; ventrals of a spine and a rudimentary ray. Head about 8; depth 9. D. LXXVIII; A. II, 38; V. I, 1; vert. 85. L. 12 inches. North Atlantic; abundant both in America and Europe.

(Blennius gunnellus L. Syst. Nat. i, 443: Centronotus gunellus Günther, iii, 285: Ophidium mucronatum Mitch. Trans. Lit. & Phil. Soc. i, 361, 1815: Gunnellus macrocephalus Girard, Bost. Journ. Nat. Hist. vi, 263, 1850: Gunellus ingens Storer, Bost. Journ. Nat. Hist. vi, 261, 1850; perhaps an abnormal specimen rather than a different genus.)

# 1169. M. fasciatus (Bloch & Schn.) Gill.

Grayish or brownish, marbled with darker, anteriorly with several irregular cross-bands, which reach the abdomen; back with a series of 10 or 12 subtriangular pale spots along the base of dorsal, each spot including some brown specks; a brown-edged pale vertical band behind eye; a brownish band from below the eye to the throat. Mouth very oblique, the snout short; interorbital width less than diameter of eye; pectoral searcely half as long as head; ventrals very small; vertical fins not joined. Head 9½; depth 9. D. LXXXVIII; A. II, 42; V. I, 1. Greenland to Alaska. (Günther.)

(Centronotus fasciatus Bloch & Schneider, 165, 1801: Gunnellus fasciatus and granlandicus Cuv. & Val. xi, 441, 442: Centronotus fasciatus Günther, iii, 287: ? Centronotus gunelliformis Günther, iii, 288.)

### 1170. M. ornatus (Grd.) Gill.

Usually greenish above, yellow or orange below, but varying to brown and cherry-red; traces of about 20 darker bars along sides; a

dark bar downward from eye; fins reddish; a V-shaped mark from eyes to occiput, grayish, bordered by jet black; the common form (lætus Cope) with about 14 red spots along base of dorsal, each with a curved black bar in front and behind, partly encircling it; others (ornatus) with about as many broad \_\_\_\_\_-shaped darker blotches, which extend on the fin, the first one or two blotches often shaped as in the form called lætus. Head naked, very narrow above; nape nearly equidistant between origin of dorsal and front of orbit; origin of anal equidistant between base of caudal and base of pectoral; pectoral 2 in head; ventrals each consisting of a spine and a ray. Head 8; depth 8. D. LXXXVIII; A. II, 37. L. 12 inches. San Francisco to Alaska; very abundant northward.

(Gunnellus ornatus Grd. Proc. Acad. Nat. Sci. Phila. 1854, 149: Centronotus nebulosus Gthr. iii, 287, part, but the Japanese M. nebulosus is a different species: Centronotus latus Cope, Proc. Amer. Phil. Soc. Phila. 1873.)

#### 1171. M. maxillaris Bean.

Brown; back with a series of 11 rounded or oblong pale spots, the longest half as long as the head; all of these spots include at the top a rather large brown spot, and below numerous little brown spots; between the first and second pale blotches are 2 very dark spots on the dorsal membrane, and below the dark spots a pale one of similar size: sides with about 26 pale bands, mostly well defined, especially anteriorly; interorbital space with a brown band, preceded and followed by a pale band half as wide; below eye 2 whitish bands, with a brown one between them. Head scaleless; mouth little oblique, the lower jaw on level of middle of eye; width of mouth equal to length of pectoral and nearly half head; mandible as long as pectoral. Eye equal to shout, a little more than interorbital width; ventral spine 3 Highest dorsal spines near front of fin, half length of mandible; eaudal half head; vent under forty-third dorsal spine, not far behind middle of body. Head S; depth 7. D. LXXXVIII; A. II, 43; V. I, 1. Saint Paul Island, Alaska. (Bean.)

aa. Ventrals reduced to a rudiment.

### 1172. M. delichogaster (Pallas) J. & G.

Brownish olive, marbled with yellowish; fins yellowish; dorsal fin with distant pale vertical bands; snout very short; cleft of mouth oblique; a pair of small bony warts ("verrucæ osseæ e cute prominulæ") in place of ventrals. Caudal fin well developed, the dorsal

and anal joined to its base. Head 7; depth 10. D. LXXXIII; A. II, 50. L. 12 inches. Kamtschatka and Alentian Islands. (*Pallas.*)

(Blennius dolichogaster Pallas, Zoogr. Ross.-Asiat. iii, 175, 1811: Centronotus dolichogaster Günther, iii, 289.)

aaa, Ventrals entirely wanting. (Asternopteryx Rüppell.)

# 1173. M. gumelliformis (Rüppell) J. & G.

Reddish brown, with 10 brown cross-bands, most distinct on base of dorsal and anal; light blotches along dorsal fin, each between two of the brown cross-bands, and each with a brown spot in the center; a light, brown-edged, vertical band below eye. Ventrals none; snout short; cleft of mouth oblique; width of interorbital space less than diameter of eye; length of pectoral 3 in head. Dorsal spines short and stiff; caudal distinct. Head 8½; depth 8. D. LXXXI; A. II, 41. (Günther.) Type supposed to be from Greenland.

(Asternopteryx gunelliformis Riippell MSS.: Centronotus gunelliformis Günther, iii, 285.)

#### 412.-APODICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila, 1854, 150: type Apodichthys flavidus Girard.)

Body elongate, compressed, covered with very small scales; no lateral line; snout short; month mederate, oblique; teeth in the jaws moderate, stouter anteriorly; vomer with teeth; gill-membranes united, free from the isthmus. Dorsal fin long, low, even, of spines only; anal fin similar, preceded by a large spine in a pouch of skin; caudal fin short, connected with dorsal and anal; no ventral fins; pectoral fins small; intestinal canal short, without pyloric eeca. Small bright-colored fishes of the Pacific. ( $a\pi a\nu z_5$ , without feet;  $iz\theta bz_5$ , fish; in allusion to the want of ventral fins.)

a. Anal spine very long, pen-shaped, excavated on anterior surface. (Apodichthys.)

#### 1174. A. flavidus Girard.

Color orange, varying with the surroundings to intense grass-green, brown, and dark purple; a few light round spots along axis of body posteriorly; a narrow black bar downwards and backwards from eye; a shorter, less-distinct bar from upper margin of orbit backwards to occiput; anal fin obliquely barred with brownish. Head short; mouth very oblique; maxillary reaching pupil; upper jaw with a series of conical teeth, behind which is a patch of smaller teeth; sides of mandible with conical teeth in a single series, forming a patch in front; vomer with three conical teeth; palatines toothless; nape equidistant between

Bull. Nat. Mus. No. 16——49

front of dorsal and pupil. Anal spine very large, two-fifths the length of head, shaped like a pen, deeply excavated on its anterior side, and very convex behind, very thin, flexible, and with sharp edges, entirely included in a pouch of skin; pectoral fins about two-fifths length of head. Head 9\frac{1}{3}; depth 7\frac{1}{3}. D. XCIII; A. I, 40. L. 18 inches. Point Concepcion to Vancouver Island; abundant; usually found below low tide-mark.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 150; Günther, iii, 290: Apodiehthys virescens Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 55: Apodiehthys inornatus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 279: Apodiehthys sanguineus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 279.)

aa. Anal spine small, not pen-shaped nor excavated.

### 1175. A. fucorum Jor. & Gilb.

Bright olive-green or deep red, the color varying with the surroundings; a row of dark spots along axis of body, these sometimes with light-bluish center, and connected by a very narrow dark streak; generally a dark streak downward from eye, but no other markings about head. Form and dentition as in A. flavidus. Mouth very oblique, the maxillary reaching center of pupil; nape nearer front of dorsal than end of snout. Anal spine comparatively small, about one-fifth length of head, transversely very convex in front, and slightly concave or grooved behind, the pouch of skin at its base little developed; pectorals very small, shorter than eye; anal fin beginning nearer tip of caudal than tip of snout by about 3 times length of head. Head 10; depth 9½. D. LXXXIII; A. 35. L. 6 inches. Monterey to Puget Sound; abundant in rock-pools and bunches of Fucus; remarkable for its active movements.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 139.)

#### 413.-ANOPLARCHUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 261: type Anoplarchus purpurescens Gill.)

Body elongated, compressed, covered with very small, imbedded scales; lateral line obsolete. Head small, compressed; eyes small; mouth oblique; teeth in each jaw in one series, of nearly uniform size; no teeth on vomer or palatines; gill-membranes broadly attached to the isthmus; branchiostegals 5. Dorsal fin not very low; no anal spines; ventrals wanting; caudal fin small, entire; pectoral fins moderate; pyloric ecca present, few. Pacific. ( $\alpha\nu\sigma\lambda\delta\sigma\varsigma$ , unarmed;  $\alpha\rho\chi\sigma\varsigma$ , anus; the anal fin being without spines.)

# 1176. A. atropurpureus (Kittlitz) Gill.

Color gravish olive, varying to brown, everywhere above finely marked with blackish reticulations; along each side of back a series of small, irregular, sharply-defined gravish spots; a series of small pale spots along lateral line; belly pale; crest and middle line of back rather pale; under parts of head yellowish; an oblique, wedge-shaped, pale streak extending downward and backward from the eye, bounded on each side by a sharp light-red line, and then by a dusky area; lower jaw mottled; dorsals olivaceous, speekled, a blackish spot on front; anal olive, tinged with red; pectorals dull orange, barred at base; caudal reddish, with narrow pale streaks, and a light bar at base; color sometimes nearly plain purplish, but more often grayish and mottled. Head with a fleshy crest, which rests on a ridge of bone; its height in older specimens about equal to eye; mouth rather large, the maxillary reaching beyond the orbit. Pectorals about half the length of head: dorsal and anal comparatively high, barely connected with the base of caudal; nape midway between origin of dorsal and pupil. depth 63. D. LVII; A. 41. Alaska to San Francisco; abundant northward.

(Ophidium atropurpureum Kittlitz, Denkwürd, einer Reise, Russ.-Amer. i, 225, 1858: Centronotus cristagalli Günther, iii, 289: Anoplarchus purpurescens Gill, Proc. Acad. Nat. Sci. Phila. 1861, 261: Anoplarchus cristagalli Günther, iii, 564.)

# 1177. A. alectrolophus (Pallas) J. & G.

Brownish-olive, darker above; a series of green blotches along the dorsal; dorsal brownish-olive, with indistinct oblique bars; anal and caudal with wavy lines; head with a longitudinal fleshy crest, extending from above eyes to nape. Anal fin beginning at anterior third of body; dorsal and anal uniting with the caudal; pectorals very small; no ventrals. Lateral line obsolete. D. LXIII; A. 44; C. 13. Island of Talek, Gulf of Penshin. (Cuv. & Val.) Perhaps identical with the preceding.

(Bleonius alectrolophus Pallas, Zoogr. Ross.-Asiat. iil, 174: Gunnellus alectrolophus C. & V. xi, 447: Centronotus alectrolophus Günther, iii, 289.)

# 411.—XIPHISTER Jordan.

(Xiphidiou Girard; preoccupied in Orthoptera.)

(Jordan, Proc. U. S. Nat. Mus. 1879, 241: type Xiphidion mucosum Girard.)

Body elongate, eel-shaped, covered with small scales; lateral lines several, viz: one along the median line of the side, one above this, and one below it; one on each side of the abdomen, the two meeting in front, and one from the occiput toward the base of the dorsal fin. Each of these has on each side, series of short branches, placed at right angles to the main line, those on opposite sides alternating. Each of these branches has about two open mucous pores. Head short, bluntish, scaleless; mouth moderate, oblique; jaws with rather strong teeth, the anterior canine-like; no teeth on vomer or palatines. Branchiostegals 6; gill-membranes separate, free from the isthmus. A single long, low, uniform dorsal fin, consisting of spines only; anal fin similar in form, with 2 small spines; candal short, joined to dorsal and anal; no ventral fins; pectoral fins very small. Intestinal canal moderately elongate, with 4–6 well-developed pyloric cœca. Herbivorous, feeding on algæ. Active fishes, inhabiting tide-pools and crevices among rocks in the North Pacific. (5icution, a sword-belt.)

### 1178. X. chirus Jordan & Gilbert.

Color olive-brown, vellowish below; sides with marblings of different shades of brown, sometimes with short blackish vertical bars; some round black spots along the back and sides; a black spot behind opercles; numerous black spots on sides of head, forming in older specimens light and dark streaks, which radiate from eye across cheeks and opercles, the pale streaks forming reticulations; dorsal with black spots, and a series of bright reddish-brown cross-blotches; pectorals and caudal plain. Head short; nape not constricted; mouth small; maxillary extending to middle of pupil; teeth strong, the anterior canine-like, bluntish; about 4 canines in lower jaw, 5 or 6 in the upper, similar to the teeth behind them, but somewhat larger. Abdominal lines meeting on the breast, but not connected with the lower lateral line. Dorsal fin beginning close behind pectoral; nape midway between middle of eye and front of dorsal; anal beginning about a head's length nearer shout than base of caudal; pectoral fin comparatively large, longer than the eye, its length about equal to distance between middle and lower lateral lines. Head 7; depth 9. D. LXX; A. II, 50. Monterey to Alaska; smaller than the other species, and living in deeper water.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 135.)

# 1179. X. mucosus (Girard) Jordan.

Blackish green, pale on belly and sides of head, marked posteriorly with olive-green in various pattern; a transverse light-greenish bar at base of caudal; 3 olive-brown streaks, radiating backward from eye, paler in the center and edged above and below with blackish, outside

of which is sometimes a streak of pale olive. These streaks all merge backward into the color of the head; middle streak broadly wedge-shaped; the third streak terminating before reaching margin of preopercle; old specimens often coarsely blotched with yellow. Lower jaw with a series of short stout conical teeth; upper jaw with a narrow band of similar teeth; 2 strong canines in upper jaw, 4 in the lower. Lower lateral line sending a branch to the abdominal line; nape not constricted. Dorsal beginning anteriorly; distance from its origin to occiput less than that from occiput to tip of snout; origin of anal nearer snout than tip of caudal by about half length of head; pectoral fin as long as eye. Head 8; depth  $7\frac{1}{2}$ . D. LXXIII; A. 48. L. 18 inches. Monterey to Alaska; very abundant among rocks and algae.

(Xiphidion mucosum Girard, U. S. Pac. R. R. Surv. Fish. 1858, 119; Xiphidion mucosum Giinther, iii, 291; Jordan & Gilbert. Proc. U. S. Nat. Mus. 1880, 137; Xiphidium cruoreum Cope, Proc. Amer. Phil. Soc. Phila. 1873.)

## 1180. X. rupestris Jor. & Gilb.

Reddish brown, uniform or variously shaded with lighter; a light olivaceous bar at base of caudal, extending on dorsal and anal: behind this a blackish area; tip of caudal usually pale; 3 long, well-defined stripes radiating backward from eye, these stripes uniform black, abruptly margined with very light olive; the central stripe proceeds straight backward from the eye, half the breadth of the cheeks, at which point it is broadest; it is then narrowed and bent abruptly downward; both the middle and lower stripes reach the margin of preopercle. Teeth essentially as in X. mucosus. The lower lateral line sends a branch to the abdominal line. A constriction at the nape. Distance from origin of dorsal to the occiput greater than the distance from the occiput to the snout. Anal fin beginning much in advance of middle of body, the distance from the first ray to tip of candal exceeding the distance to snout by nearly twice length of head; pectoral very short, its length less than diameter of eye. Head 8; depth 9. D. LXVI; A. 50. L. 12 inches. Smaller than the preceding, and equally abundant; among rocks and algae, from Alaska to Monterey.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 137.)

### 415.—CEBEDICHTHYS Ayres.

(Ayres, Proc. Cal. Acad. Nat. Sci. i, 59, 1855: type Cebedichthys cristagalli Ayres = Apodichthys riolaccus (Grd.)

Body comparatively short, compressed, covered with minute scales; lateral line distinct, running very high, with very short branches, each ending in a pore, as in *Xiphister*, but the branches more oblique and less regular. Head short; erown with a conspicuous fleshy longitudinal crest in the adult; jaws subequal, with conical teeth; villiform teeth on vomer and palatines; gill-membranes united, free from the isthmus. Dorsal fin continuous, long and low, the anterior part composed of sharp spines, which are rather lower than the soft rays; caudal fin rounded, connected with dorsal and anal; anal fin similar to soft dorsal, with 1 or 2 small spines; pectorals small; ventrals wanting. Intestinal canal elongate, with several pyloric eœca. Pacific Ocean. Herbivorous, similar in habits to the species of *Xiphister*.  $(z\tilde{\eta}\beta\sigma_{5})$ , the Sapajou, a kind of monkey;  $i\chi\theta\dot{\sigma}_{5}$ , fish; in allusion to the "peculiar monkey-like" physiognomy as seen from the front.)

# 1181. C. violaceus (Ayres) Grd.

Dull olive grayish, mottled with lighter, sometimes reddish tinged; vertical fins all edged with reddish; cheeks with 3 darker stripes, edged with paler, one downward and backward from the eye, close behind angle of mouth; another above it to root of pectoral; another running upward and backward from the eye, and meeting its fellow over the erest. Maxillary extending to or beyond orbit. Dorsal scaly at base; vent nearer snout than base of caudal; pectoral two-fifths length of head; nape midway between dorsal and eye. Head 6½; depth 6. D. XXIII, 41; A. I, 41. L. 30 inches. San Francisco to Point Concepcion; abundant.

(Apodichthys riolaceus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 150: Cebedichthys cristagalli Ayres, Proc. Cal. Acad. Nat. Sci. i, 58, 1855; Girard, U. S. Pac. R. R. Surv. Fish. 121; Günther, iii, 260.)

### 416.—EUMESOGRAMMUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1864, 210; type Clinus præcisus Kröyer.)

Body comparatively short, the back somewhat arched; mouth rather large, the jaws with villiform teeth; teeth on vomer and palatines. Scales small; lateral line present, median, with one or more accessory branches; pectorals and ventrals well developed. Dorsal moderately high, of spines only, slightly connected with the rounded caudal; gill-openings continued forwards below, the membranes narrowly joined to the isthmus; pyloric coca present. (ε΄, well; μέσος, middle; γραμμη, line; the longest lateral line being the middle one.)

a. Lower lateral line present.

# 1182. E. præcisus (Kröyer) Gill.

An ovate, black, white-edged spot between the sixth and tenth dorsal spines. Snout subconical; cleft of mouth slightly oblique; vomerine

and palatine teeth present; 3 lateral lines on each side, the median continued to the base of the caudal; ventral fin half as long as the pectoral, which is much shorter than head; dorsal fin terminating just at root of caudal. Head 4; depth nearly 6. D. XLIX; A. 34; V. 3. Greenland. (Günther.)

(Clinus pracisus Kröyer, Naturh, Tidsskr. i, 25, 1836; Clinus unimaculatus Reinh, Vid. Selsk, vii, 114, 1837; Stichaus unimaculatus Günther, iii, 283; Gill, I. c. 210.)

aa. Lower lateral line wanting.

# 1183. E. subbifurcatus (Storer) Gill.

Brownish, with several round paler blotches above at the base of the dorsal fin; spaces between these blotches darker, appearing like bars; a broad black bar crossing the opercle obliquely from below the orbit, and two parallel dark bars running backwards from orbit; belly yellowish white; dorsal fin with numerous black dots. Mouth rather large; maxillary reaching to below orbit; back somewhat arched; ventral outline nearly straight; eyes large; lower lateral line wanting; upper branch of lateral line about two-thirds length of head. Head  $4\frac{1}{3}$ ; depth nearly 5. D. XLIV; A. 30. North Atlantic, south to Cape Cod.

(Pholis subbifurcatus Storer, Rep. Fish. Mass. 1839, 63.)

#### 417.-STICHÆUS Reinhardt.

(Reinhardt, Dansk. Vidensk. Natur. og Math. Afhandl. 1837, 109: type Blennius punctatus Fabricius.)

Body comparatively short and compressed, covered with small scales; teeth on jaws, vomer, and palatines. Lateral line present, single, median; pectorals and ventrals well developed. Dorsal moderately high, of spines only, free from the caudal; gill-openings continued forward below, the membranes narrowly united to the isthmus; pyloric cœca present. (στἴγάω, to set in rows.)

# 1181. S. punctatus (Fabric.) Kröyer.

Scarlet; dorsal with a series of round black spots, white-edged posteriorly; head below with 5 brownish cross-bands; a brown streak from snout through eye. Snout subconical. Dorsal spines of moderate length. Eye half interorbital width. Head 54 in total length; depth 8. D. XL; A. I, 35. (Günther.) Polar seas, south to Cape Cod and Alaska.

(Blennius punctatus Fabric, Faun. Grön. 153, 1780: Kröyer, Naturh. Tidsskr. i, 377, 1837; Günther, iii, 283.)

#### 418.-NOTOGRAMMUS Bean.

(Bean, Proc. U. S. Nat. Mus. iv, 147, 1881: type Stichaus rothrocki Bean.)

This genus differs from *Stichaus* in the presence of a single lateral line along the base of the dorsal fin. It is known, however, from immature examples only. The caudal fin is emarginate, a character unusual in this family.  $(2\tilde{\omega}\tau\sigma\tau, \text{back}; \gamma\rho\alpha\rho\rho\dot{\eta}, \text{line.})$ 

#### 1185. N. rothrocki Bean.

Pale brown, with 3 series of paler spots, those of the median series usually longer and narrower than the others; a series of about 10 pale spots on median line of back, the anterior as large as eye: a dark stripe around snout to end of operele; a very narrow dark stripe along base of dorsal, its lower margin seeming to mark the course of the superior lateral line. Body covered with minute scales; lateral line undeveloped (in the immature specimens known), apparently running close to outline of back. Teeth in the jaws, and apparently on vomer and palatines. Gill-membrane deeply cleft, free from the isth-Eye 4 in head, as long as the subconical snout; maxillary reaching front of pupil. Dorsal beginning above upper axil of pectoral; like the anal, connected by a low membrane with the caudal; candal emarginate behind; ventrals short, close together, 3 in head, and not half as long as pectorals; longest dorsal spines half height of Head 4½; depth 6. B. 6. D. XLVIII; A. I, 34; V. I, 4; P. 15; body. Northern Alaska and Siberia.

(Stichwus? rothrocki Bean, Proc. U. S. Nat. Mus. iv, 146, 1881.)

#### 419.-LUMPENUS Reinhardt.

(Leptogumnellus Ayres: Leptoclinus and Anisarchus Gill.)

(Reinhardt, Dansk. Vidensk. etc. 1837, 110: type Blennius lumpenus Fabr..)

Body greatly elongate, moderately compressed, covered with small scales; lateral line indistinct or obsolete. Head long; snout short; no cirri; eyes large, placed high; mouth moderate, with a single row of rather small, conical teeth on each jaw; teeth present on vomer or palatines; gill-openings prolonged forward below, very narrowly united anteriorly to the isthmus, not forming a free fold across it. Dorsal composed of numerous, sharp, flexible, rather high, spines; candal fin long; anal many-rayed; pectorals large, more than half length of head; ventrals well developed, jugular, I, 3 or I, 4; intestinal canal long; pyloric cœca present; no air-bladder. Chiefly herbivorous. Northern seas. (Lumpen, a Danish name of some similar fish.)

a. Teeth on vomer and palatines; pectorals with the upper and middle rays shortened, shorter than the lower (Leptoclinus\* Gill.)

# 1186. L. maculatus (Fries) Nilss.

Yellowish; a series of 5 large dark spots along the base of the dorsal fin, between which are smaller and fainter spots; dorsal and caudal barred. Caudal fin truncate, free from dorsal and anal; ventrals half as long as head; pectorals large, about as long as head. Anterior rays of dorsal short and free. Teeth on vomer and palatines; lower jaw included; maxillary reaching middle of eye. Head 6. D. LX; A. 36. (Collett.) Greenland to Spitzbergen; occasional southward, in deep water.

(Clinus maculatus Fries Kgl. Vet. Ak. Handl. 1837, 49: Clinus aculeatus Reinh. Dansk. Vidensk. Selsk. Natur. Afhandl. vii, 114, 122, 194, 1838: Stichwus maculatus and aculeatus Günther, iii, 281; Collett, Norske Nord-Havs Exp. 1880, 67.)

- aa. Teeth on jaws and palatines, none on vomer; pectorals with the middle rays longest, the lower ones shortened.
  - b. Anterior half of anal fin with the rays shortened. (Anisarchus + Gill.)

### 1187. L. medius (Reinh.) Kröyer.

Yellowish, nearly plain. Lower jaw searcely included, the maxillary reaching front of eye; teeth on palatines, none on vomer; ventrals slender, one-third length of head; lower rays of pectoral shorter than middle ones, the fin shorter than head. Dorsal and anal slightly joined to the truncate candal; anterior half of anal with the rays shortened. Head 6; depth 10. D. LXI; A. 42; V. I, 3. Greenland to Norway and Spitzbergen. (Collett.)

(Clinus medius Reinh. Dausk, Vidensk, Afhandl. 1838, 114: Lumpenus medius Kröyer, Naturh. Tidsskr. i, 377, 1837: Stichaus medius Giinther, iii, 281: Anisarchus medius Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209; Collett, l. c. 62.)

bb. Anal rays subequal. (Lumpenus.)

# 1188. L. anguillaris (Pallas) Gill.

Olive green above, pale below; sides marked above with dark olive brown; a series of more or less distinct oblong blotches of olive brown along middle of sides; dorsal barred or spotted; anal pale; opercle with a dark blotch; head dusky above. Checks scaly; month somewhat oblique, the lower jaw included; maxillary reaching front of pupil; teeth on palatines, none on the vomer; sides of each jaw with 1 or 2 larger teeth. Gill-openings prolonged forward a distance greater than length of snout; pyloric ecca 4, unequal. Fins all comparatively

<sup>\*</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209: type Clinus acaleatus Reinh. (λεπτός, slender; κλίνος, Clinus.)

<sup>+</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209: type Clinus medius Reinh. ( $\alpha\nu\iota\delta\sigma\delta$ , unequal;  $\alpha\rho\chi\delta\delta$ , anus.)

high; pectorals two-thirds length of head, the middle rays longest; ventrals one-third length of head. Dorsal and anal distinct from the pointed caudal, which is nearly as long as head. Head 8; depth 14. D. LXXI; A. 46; V. I, 4; B. 7. L. 18 inches. San Francisco to Alaska; very abundant northward.

(Blennius anguillaris Pallas, Zoogr. Ross.-Asiat. iii, 176, 1811: Leptogunnellus gracilis Ayres, Proc. Cal. Acad. Nat. Sci. i, 26: Lumpenus anguillaris Girard, U. S. Pac. R. R. Surv. Fish. 123: Stichwus anguillaris Giinther, iii, 282.)

# 1189. L. fabricii (Cuv. & Val.) Kröyer.

Light brown, clouded with darker. Upper jaw scarcely longer than lower. Vertical fins separate; pectorals large; ventrals very slender. Depth 14. D. LXIII; A. 41; V. I, 3. Greenland. (Cuv. & Val.)

(Blennius lumpenus Fabricius, Fauna Grönl. 151: Gunnellus fabricii Cuv. & Val. xi, 431: Stichæus lumpenus Günther, iii, 280.)

### 420.—LEPTOBLENNIUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1860, 21: type Blennius serpentinus Storer.)

Body greatly elongate, covered with small scales; head rather slender; teeth very small, in a single series in each jaw; none on the vomer or palatines. No lateral line; no cirri; gill-openings somewhat prolonged forwards, narrowly united to the isthmus. Dorsal fin very long, continuous, of spines only; ventrals well developed, of 1 spine and 2 or 3 rays; pyloric coca present. This genus is hardly worthy of separation from Lumpenus. ( $\lambda \varepsilon \pi \tau \delta \varepsilon$ , slender; Blennius.)

a. Dorsal spines 60-65. (Centroblennius Gill.\*)

### 1190. L. nubilus (Rich.) J. & G.

Pale olive, marbled with darker. Upper jaw slightly longest; no teeth on vomer or palatines. Vertical fins not continuous; ventrals slender, one-third length of head; pectoral fin oyate, the middle rays longest. D. LXIII; A. 43; V. I, 4. Wellington Sound. (*Richardson*.)

(Lumpenus nubilus Rich. Last Arctic Voyage, Fish. 13, pl. 28: Stichæus unbilus Günther, iii, 564: Centroblennius nubilus Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209.)

aa. Dorsal spines 70-80. (Leptoblennius Gill.)

### 1191. L. serpentinus (Storer) Gill.

Olive above, with lighter cloudings; pale below; dorsal fin brownish, with broad, oblique, white bands; pectorals pale. Head not large, its sides sparsely covered with small scales; eye as long as snout; maxillary reaching front of pupil; gill-openings extending forward below, for a distance less than length of snout; pectorals long, seven-eighths

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1860, 21: type Lumpenus nubilus Rich.

length of head; ventrals moderate, 2<sup>2</sup>/<sub>3</sub> in head. Head 9; depth 15, D. LXXV; A. 50; V. I, 3. L. 12 inches. Cape Cod to Greenland.

(Blennius serpentinus Storer, Proc. Bost. Soc. Nat. Hist. iii, 30, 1848; Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209.)

# 1192. H. Emmapotrirformis (Walb.) J. & G.

Yellowish, with numerous brown spots of different sizes; candal banded. No teeth on vomer or palatines; maxillary reaching front of eye. Caudal free, acuminate; first three or four rays of dorsal short and almost free; pectoral convex, shorter than head; vent well forward. Head 9. D. LXXII; A. 50; V. 1, 3. (Collett.) Greenland to Norway and Spitzbergen.

(Blennius lampetraformis Walbanm, Artedi, Pisc. 1792, 184; Clinus nebulosus Nilss. Skand. Faum. 1855, 195; Stichwus islandiens Günther, iii, 281; Blennius gracilis Stuwitz. Nye Magaz. f. Naturv. i, 406, 1838; Clinus nebulosus Fries Vet. Akad. Handl. 1837, 55; Leptoblennius gracilis Gill, l. c. 210; Lumpenus lampetraformis Collett, Norske Nordhavs Exp. 1880, 71.)

### 421.-DELOLEPIS Bean.

(Bean, Proc. U. S. Nat. Mns. 1882: type Delolepis vivgatus Bean.)

Body anguilliform, moderately compressed posteriorly, covered with small, imbricated, cycloid scales; vent nearly median; a small anal papilla; lateral line continuous, straight, nearly median, composed of open pores, without prominent tubes. Head oblong, subanadrangular, naked, the muciferous channels well developed, the vertex shallowconcave; snout short, obtuse; nostril single, tubular, close behind premaxillary; eyes small, high, separated by an interspace of moderate width, surrounded by a series of shallow pits; mouth wide, oblique, terminal, the lower jaw projecting beyond the upper; lips fleshy; premaxillaries slightly protractile, with 2 rows of small conical teeth: a few larger teeth at the symphysis; vomer and palatines with a few rather large teeth; tongue smooth, adherent; mandible with a few shallow pits, the series continued on the posterior border of preopercle; opercles unarmed. Gill-membranes attached to a narrow isthmus; gill-rakers very short; pseudobranchiae present. Branchioste-Pectorals short, placed low, their bases vertical; ventrals none; dorsal beginning above gill-opening, composed entirely of spines; anal with 2 spines and many split rays; dorsal and anal continuous with the candal, which is rather long and pointed. Intestine short, with a few pyloric cœca. ( $\partial \hat{\chi} \lambda \sigma z$ , visible;  $\lambda \xi \pi c z$ , scale.)

# 1193. D. virgatus Bean.

Brownish yellow; a brown stripe along lateral line; another along

back; a third along base of anal. Width of head equal to greatest depth of body; interorbital area equal to snout, or one-third length of mandible; maxillary reaching a little behind eye, its length 3 in distance from snout to front of dorsal; eye 2 in snout, 11 in head. Beginning at a short distance behind origin of dorsal, small, oblong, cycloid scales, closely imbricated, cover a strip of the body along the lateral line; the scaled area gradually widens backward until, behind the vent, only a very narrow strip along bases of dorsal and anal is naked. Dorsal beginning over upper angle of gill-opening; first spine half as long as the seventy-first or longest; caudal 11 in length; pectoral 3 in head. Head 6; depth 10. D. LXXVI; A. II, 46; P. 13; ecca 6. L. 30 inches. Coasts of British Columbia and Alaska. (Bean.) (Bean, Proc. U. S. Nat. Mus. 1882)

### 422.—CRYPTACANTHODES Storer.

# Wry-mouths.

(Storer, Rept. Fish. Mass. 1839, 28: type Cryptacanthodes maculatus Storer.)

Body very long and slender, compressed, naked; lateral line obsolete; head oblong, euboid, with vertical cheeks; conspicuous muciferous channels in mandible and preopercle; head flattish above, with deep rounded pits between and behind eyes; mouth large, very oblique; lower jaw very heavy, its tip projecting; premaxillary not protractile; jaws with rather sharp, conical teeth; larger teeth on the vomer and palatines; most of the teeth in single series. Gill-membranes joined to the isthmus; the gill-openings prolonged forwards below; pyloric ecea 5. Dorsal fin long, composed entirely of spines, which are rather strong, but enveloped in the skin; dorsal and anal joined to the caudal; no ventral fins; pectorals short. Size rather large; one species known. ( $z\rho v\pi \tau \delta \tau$ , hidden;  $aza^3\theta \delta \phi \eta \tau$ , spined.)

# 1194. C. maculatus Storer.—Wry-mouth; Ghost-fish.

Light brownish, with several series of smallish dark spots, arranged in more or less regular rows, from the head to the base of the caudal; vertical fins closely spotted with darker; head above thickly speckled; body sometimes ("inornatus") entirely immaculate. Eyes small, placed high, not so wide as the interorbital space, which has 2 ridges and 3 pits; orbital rim raised; 2 deep pits behind eye at the temples; a deeper pit on the top of head between them; a raised ridge continued backward on each side of head behind orbital rim; maxillary extending to beyond eye; pseudobranchiae small; pectorals short, 3 in

head, their tips reaching beyond front of dorsal; vent a little in front of middle of body. Head 6½; depth 13. D. LXXIII; A. 50. North Atlantic, south to Cape Cod; not very common.

(Storer, Rept. Fish. Mass. 1839, 98; Günther, iii, 291; Cryptacanthodes inornatus Gill, Proc. Acad. Nat. Sci. Phila. 1863, 332, albino form.)

### 423.—ANARRIHCHAS Linnaus.

Wolf-fishes.

(Artedi; Linnæus, Syst. Nat.: type Anarrhichas lupus L.)

Body moderately elongate, covered with rudimentary scales; head scaleless, without cirri, compressed, narrowed above, the profile strongly decurved; mouth wide, oblique; premaxillary not protractile; jaws with very strong conical canines anteriorly; lateral teeth of lower jaw either molar or with pointed tubercles; upper jaw without lateral teeth; vomer extremely thick and solid, with 2 series of coarse molar teeth; palatines with 1 or 2 similar series. Gill-membranes broadly joined to the isthmus; no lateral line. Dorsal fin rather high, composed entirely of flexible spines, which are enveloped in the skin; anal fin lower; caudal fin developed, free from dorsal and anal; no ventral fins; pectoral fins broad, placed low; air-bladder present; no pyloric cocca. Northern seas. (Anarrhichas (or Scansor), an ancient name of A. lupus; from araphydogai, to climb or scramble up; the allusion not evident.)

### 1195. A. lupus Linn.-Wolf-fish.

Brownish; sides with numerous (9-12) very dark transverse bars, which are continued on the dorsal fin, besides numerous dark spots and reticulations; fins dark; candal tipped with reddish. Maxillary reaching beyond orbit; band of vomerine teeth extending much farther back than the short palatine band. Pectorals large, rounded, two-thirds length of head. Dorsal high, beginning over the gill-opening, its longest rays about half length of head. Head 6; depth 5½. D. LXII; A. 42. North Atlantic; rather common both in America and Europe.

(Linneus, Syst. Nat. i, 430, 1766; Günther, iii, 208; Bean, Proc. U. S. Nat. Mus. ii, 1879, 217; Anarrhichus romerinus Storer, Hist. Fish. Mass. 1867, 99, the American form.)

#### 1196. A. minor Olafsen.

Sides without vertical bars, but with many large, round, black spots. Vomerine teeth extending nearly or quite as far back as the palatines. (Bean.) North Atlantic.

(Olafsen, Reise i Island, 1772, 592: Anarrhichas pantherinus Zoniew, Nov. Act. Petrop. 1781, 271; Bean, Proc. U. S. Nat. Mus. ii, 217, 1879.)

# 1197. A. latifrons Steenstrup & Hallgrimsson.

Brown, obscurely spotted with darker; the sides without dark bars. Head broad, the profile not strongly decurved; teeth much smaller; vomerine teeth not extending nearly as far back as the palatine series. Pectorals three-fifths length of head; dorsal fin not very high, beginning above the gill-opening, the longest spine less than half head; candal  $2\frac{1}{2}$  in head. Head 5; depth 4. D. LXVII; A. 45. (Collett.) North Atlantic.

(Steenstrup & Hallgrimsson, Förh. Skand. Naturf. 3 die Möte, 1842, 647; Bean, Proc. U. S. Nat. Mus. ii, 218, 1879; Collett, Meddelsk. Norges Fiske, 1879, 46.)

### 1198. A. lepturus Bean.

Dark brown, without bands or spots; belly pale, clouded with very dark brown. Head moderate; maxillary half as long as head; 4 large canines in the upper jaw and 5 in the lower, all of them strongly recurved; behind the canines in each jaw are a few sharp, conical teeth, also recurved; palatine teeth in 2 series, 4 in the outer and 5 in the inner series, those in the outer series the longer; vomerine teeth in 2 series, the vomerine patch beginning in advance of the palatine, and extending farther back than the latter; head and fins scaleless; median line of body, and all of tail with small, widely-separated scales. Head  $4\frac{1}{2}$ ; depth 5. D. LXXXI; A. 52. (Bean.) Alaska.

(Bean, Proc. U. S. Nat. Mus. ii, 212, 1879: ?? Anarrhichas orientalis Pallas, Zoogr. Ross.-Asiat. iii, 77, 1811.)

# 424.—ANARRHICHTHYS Ayres.

(Ayres, Proc. Acad. Nat. Sci. i, 32, 1855: type Anarrhichthys ocellatus Ayres.)

Body elongate, tapering backward into a very long and compressed tail, around which the dorsal and anal are confluent with the caudal. Scales rudimentary; no lateral line. Dorsal high, composed entirely of flexible spines; pectoral fins broad, placed low; no ventral fins. Head very large, compressed, the snout rather short; month large; jaws with very strong, conical canines anteriorly; vomer and palatines each with about 2 rows of coarse molars, the palatine band shutting against similar teeth on the sides of the lower jaw. Gill-membranes broadly united to the isthmus. No pyloric cœca. Large fishes of the North Pacific. (αναρφυχας, Anarrhichas; ὶχθός, fish.)

# 1199. A. ocellatus Ayres.

Dark grayish or greenish, the body and dorsal fin everywhere covered with round, occllated black spots of various sizes, the light mark-

ings forming reticulations around the spots; head paler, with the reticulations in much finer pattern; anal pale-edged. Pectorals broad, more than half length of head. Longest spines of dorsal half length of head. Head 11; depth 15. D. CCL; A. 233; P. 19. L. 5-8 feet. Pacific coast, from Monterey north to Puget Sound. Feeds largely on Echinoids.

(Ayres, Proc. Cal. Acad. Nat. Sci. i, 31, 1855; Anarrhichthys felis Girard, U. S. Pac. R. R. Surv. Fish. 1858, 125; Anarrhichthys felis Günther, iii, 211.)

# FAMILY CXV.—LYCODIDÆ.\*

(The Eclpouts.)

Body elongate, more or less eel-shaped, naked or covered with very small, imbedded, eyeloid scales; head large; mouth large, with conical teeth in jaws, and sometimes on vomer and palatines; bones of head unarmed. Gill-membranes broadly united to the isthmus; pseudobranchiae present; gills 4, a slit behind the fourth. Dorsal and anal fins very long, of soft rays only, or the former with a few posterior spines; vertical fins confluent around the tail; pectorals small; ventrals jugular, very small or wanting. Lateral line obsolete or nearly so. Gill-rakers small; pyloric cœca rudimentary; vent not near the head. Genera about 6; species 30. Bottom fishes, chiefly of the Arctic and Antarctic seas; some of them, and perhaps all, are viviparous.

(Lycodidæ Günther, iv, 319-326: genus Zoarces Günther, iii, 295: Zoarchidæ Swainson.)

- a. Dorsal fin low behind, some of its posterior rays short and spine-like; ventrals small. (Zoarcinæ.)
- - c. Ventral fins present.
    - d. Vomer and palatines toothless; scales present......Lycoporsis, 426. dd. Vomer and palatines with teeth.
  - cc. Ventral fins wanting.

    - ff. Jaws unequal, the lower projecting .......URONECTES, 430.

<sup>\*</sup>The six families following (Lycodidæ, Congrogadidæ, Fierasferidæ, Ophididæ, Gadidæ, Macruridæ) constitute the group or suborder of Anacanthini or Jugulares, distinguished from the other Acanthopteri by the long dorsal and anal fins, which are composed of soft rays only. The ventral fins, if present, are jugular. The present family is called Zoarcidæ in the key, on page 79.

### 425 .- ZOARCES Cuvier.

# Eelpouts.

(Cuvier, Règne Anim. ed. 2, ii, 240, 1829: type Blennius viriparus L.)

Body clongate, compressed, tapering posteriorly; head oblong, heavy, narrowed above, the profile decurved; month large; teeth strong, conic, bluntish, in 2 series in the front of each jaw, and 1 series on the sides; teeth in outer series larger; no teeth on vomer or palatines. Dorsal fin very long, low, some of its posterior rays much lower than the others, developed as sharp spines; pectoral fins broad; ventrals jugular, of 3 or 4 soft rays. Scales small, not imbricated, imbedded in the skin. Size large. (ζώαρχής, viviparous.)

a. Numbers of fin rays and vertebræ increased. (Macrozoarces Gill.)

1200. Z. anguillaris (Peck) Storer.—Eelpout; Mutton-fish; Mother of Eels.

Reddish brown, mottled with olive, the scales paler than the skin about them; dorsal fin marked with darker; a dark streak from eye across cheeks and opercles; lower jaw included; maxillary reaching beyond orbit; pectoral long, about two-thirds length of head; ventrals one-fifth head; highest ray of dorsal about equal to snout; the posterior spines about one-third length of eye; first ray of dorsal above preopercle. Head 6; depth 7. D. 95, XVIII, 17; A. 105. L. 20 inches. Delaware to Labrador; rather common northward. Two forms, perhaps distinct species (anguillaris, ciliatus) occur, distinguished by the size of the jaws.

(Blennius anguillaris Peck, Mem. Amer. Acad. Sci. ii, 46; Storer, Fish. Mass. 263; Günther, iii, 296: Euchelyopus anguillaris Gill, Proc. Acad. Nat. Sci. Phila. 1863, 258: Zoarces labrosus and Z. fimbriatus Cuv. & Val. xi, 466, 468: Blennius ciliatus Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 375, 1815, the large-mouthed form.)

#### 426.-LYCODOPSIS Collett.

(Leurynnis Lockington.)

(Collett, Proc. Zoöl. Soc. London, 1879, 381: type Lycodes pacificus Collett.)

Body elongate, eel-shaped, covered with small, smooth, imbedded scales. Head large; snout broad and long; interorbital space very narrow; mouth large, horizontal; teeth conical, those of the upper jaw in a single row; those of the lower in a band in front, the inner series enlarged, larger than the upper teeth; no teeth on vomer or palatines. Ventral fins very small; vertical fins continuous, without spines. ( $\lambda \delta z \omega \delta \eta_5$ , Lycodes;  $\delta \psi \iota_5$ , appearance.

### 1201. L. pacificus Collett.

Light-reddish olive, becoming lighter below; vertical fins margined with black; the scales paler than skin, forming light spots; pectorals dusky. Head comparatively short; orbital region not constricted, nor cheeks tunid; mouth comparatively small, the maxillary reaching center of pupil; head, nape, and axil of pectoral naked. Dorsal and anal fins enveloped in thick skin, which is covered with imbedded scales like those on the body; pectoral half the length of head; ventrals half length of orbit; mandible half length of head; distance from shout to base of dorsal,  $4\frac{1}{2}$  in length. Head  $5\frac{1}{2}$ ; depth  $8\frac{1}{2}$ . D. 100; A. 85. L. 12 inches. San Francisco to Puget Sound; rather common in deep water; the original type said to be from Japan.

(Lycodes pacificus Collett, Proc. Zoöl. Soc. London, 1879, 381.)

# 1202. L. paucidens (Lockington) Gill.

Very similar to *L. pacificus*, but larger, with larger head and month; snont very broad; orbital region constricted; cheeks tumid; maxillary extending about to posterior edge of orbit. Pectoral two-fifths length of head; ventrals half orbit; mandible three-fifths length of head; distance from snont to base of dorsal, 3\frac{3}{4} in length. Head 4\frac{1}{2}; depth 10. Off San Francisco in deep water; possibly a variety or state of the preceding, corresponding to the "variety" ciliatus of Zoarces anguillaris.

(Lenrynnis pancidens Lockington, Proc. U. S. Nat. Mus. 1879, 326; Gill, Proc. U. S. Nat. Mus. 1880, 248.)

### 427.-LYCODES Reinhardt.

(Reinhardt, Kongl. Danske Vidensk. Selsk. Naturv. vii, 153, 1838: type Lycodes vahli Reinh.)

Body elongate, more or less eel-shaped, tapering behind. Head oblong; mouth nearly horizontal; lower jaw included; conical teeth on jaws, vomer, and palatines, those on jaws and palatines mostly in a single series. Dorsal fin beginning behind bases of pectorals, without spines; pectorals moderate, inserted rather high; ventral fins small, of 3 or 4 rays. Scales small and imbedded, present on part or all of the body, the scaly area more extensive in the adult than in the young. No air-bladder nor pyloric ceca. Species numerous, chiefly of the Northern seas. ( $\lambda \delta z d \delta \partial \eta z$ , wolfish.)

a. Body elongate, its depth 12-24 times in length.

### 1203. L. paxillus Goode and Bean.

Color probably light brown. Body very elongate; head broad, flat Bull. Nat. Mus. No. 16——50

above, the profile abruptly decurved; upper jaw extending far beyond the lower; cheeks very full and protuberant; teeth of both jaws in a single series except at the symphysis; a few teeth clustered at the head of the vomer; palatines with a single series; teeth very stont, recurved and sharply pointed; scales covering the entire body and extending on the bases of the vertical fins; head and pectoral fins scaleless; dorsal fin inserted at less than one-fourth the entire length from the snout. Head 7; depth 17. D. 116; A. 100. (Goode & Bean.) Le Have Banks.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 44.)

### 1204. L. verrilli Goode & Bean.

Light grayish brown above; below, pearly white; sides with irregular brown patches bisected by the lateral line; abdominal region livid blue; a spot of brown on the tip of tail. Body very elongate. Head much depressed; maxillary nearly reaching posterior margin of orbit; upper jaw much the longer; profile very convex, snout obtusely rounded above. Head  $5\frac{2}{3}$ ; depth about 13. D. 92; A. 88. (Goode & Bean.) Coast of Massachusetts and northward, in deep water.

(Goode and Bean, Amer. Journ. Sci. Arts, xiv, 1878, 474.)

au. Body moderately elongate, its depth 6-10 times in the length.

### 1205. L. vahli Reinhardt.

Brownish yellow, with 6 blackish cross-bands extending on the dorsal fin and confluent on the belly; the first cross-band on and below the anterior dorsal rays, the second above the vent; adults nearly uniform blackish. Head nearly twice as long as high; snout long, the maxillary reaching to opposite middle of eye; distance of vent from ventrals nearly equal to length of head; ventral fins less than one-fourth as long as pectorals; vertical fins scaly; body wholly scaly. Head  $4\frac{1}{3}$ ; depth 8. D. 116; A. 93; V. 4; vert. 25 + 87. North Atlantic. (Günther.)

(Reinhardt, Dansk, Vidensk, Selsk, Afhandl, vii, 153, 1838; Günther, iv, 319; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 260.)

#### 1206. L. esmarki Cellett.

Brownish black, with a whitish-yellow patch on the nape, and 5-8 transverse bands of the same color across the dorsal and posteriorly across the anal, these bands becoming broken into annular spots, with age. Body behind front of dorsal scaled; vertical fins scaly; nape scaly; snont obtuse; maxillary not more than half head; lateral line indistinct, divided; pectorals 8 in length. Head  $4\frac{1}{2}$ ; depth 8. D. 110;

A. 95; P. 22; V. 4. Nova Scotia to Finnark and Spitzbergen. (Collett.)

(Collett, Norges Fiske 1874, 95; Collett, Norske Nord-Havs Exp. 1880, 84; Lycodes validi Goode & Bean, Proc. U. S. Nat. Mns. 1879, 209, not of Reinh.)

#### 1207. L. retientatus Reinh

Brownish, with reticulated black lines on the head and body; those on the body disposed in 5 groups or cross-bands, the three anterior of which emit 1 or 2 vertical streaks on the dorsal fin; dorsal darkedged. Body entirely scaly; vertical fins naked. Head twice as long as high; snout long; maxillary extending to behind middle of eye; distance from vent to ventrals more than length of head. Head 4; depth about 8. D. 94; A. 75; V. 4; cœca 2. L. 14 inches. Greenand, south to the Grand Banks.

(Reinhardt, l. c. 167; Günther, iv., 320; Gill, l. c. 200; Collett, l. c. 84; Lycodes rossi Malmgr, 1864; Lycodes gracilis Sars, Christ, Vid. Selsk. Forh, 1866; Lycodes perspicillum Kröyer, Dansk. Vidensk. Selsk. Afhandl. 1845, 233; Lycodes perspicillum Günther, iv. 320; Lycodes perspicillum Gül, Proc. Acad. Nat. Sci. Phila. 1863, 260.)

#### 1208. L. seminudus Reinh.

Color uniform pale grayish brown, without spots or bands. Body naked in front of vent, scaly behind; fins naked. Head large. Distance of ventrals from vent somewhat more than length of head. Head 3½; depth 7. D. 91; A. 74; P. 21; ccca 2. Greenland to Spitzbergen. (Collett.)

(Reinhardt, Kong. Dansk. Selsk. etc. 1838, 223; Günther, iv. 350; Gill, l. c. 260; Collett, l. c. 113.)

# 1209. L. nebulosus Kröyer.

Brown, with small, faint, yellow, transverse bands across the back Body naked anteriorly; the posterior part of dersal fin scaly; the anal naked or nearly so. D. 87; A. 68; P. 19; V. 3. Greenland. (Kröyer.) An imperfectly-described species, unknown to recent writers.

(Kröyer, l. c. 1844, 140; Gill, l. c. 260.)

#### 1210. L. coccineus Bean.

Brown, red below; pectorals reddish brown above, earmine below: 9 bluish-white bands on the dorsal; a few whitish blotches on sides and on head; anal brownish red; head white below; a whitish blotch as large as eye at upper angle of gill-opening. Posterior two-thirds of tail covered with separated scales; rest of body, head, and fins, scaleless; lateral line visible only on scaly part of body, consisting of a few faint, short, linear scratches. Pectoral twice as long as premaxillary, falling short of the vent by its own length; dorsal beginning over

anterior half of pectoral; anal under twenty-first dorsal ray; tail stout. Head 4; depth 7½; B. 6. D. 87 (with half of caudal); A. 87 (with half of caudal); P. 18; V. 3. L. 20 inches. Big Diomede Island, Bering's Strait. (Bean.)

(Bean, Proc. U. S. Nat. Mus. iv, 144, 1881.)

#### 428 .- LVCODALEPIS Bleeker.

(Bleeker, Verl. Akad, Amst. ed. 2, viii, 369; type Lycodes mucosus Rich.)

This genus differs from Lycodes in the total absence of scales. ( $\lambda \upsilon z \dot{\omega} \partial \eta z$ , Lycodes;  $\dot{\omega} \lambda z \pi \iota z$ , without scales.)

# 1211. L. mucosus (Rich.) Bleeker.

Blackish, with irregular white markings in the form of 5 narrow bars across the back; lower parts of head and trunk whitish. Body robust; head very large; snout long, its length 3 in head; mouth large, the maxillary extending to beyond eye; distance from vent to ventrals more than length of head; eye very small, 11 in head. Ventrals very small; pectorals large and broad. Head  $3\frac{1}{4}$ ; depth 8. D. 90; A. 70; V. 3; vert. 26 + 66; exca 2. L. 18 inches. Arctic seas.

(Lycodes mucosus Rich, Last Arctic Voyage, 362: Lycodes mucosus Günther, iv, 320: Lycodes mucosus Bean, Bull. U. S. Nat. Mus. xv, 112, 1879.)

# 1242. L. turmeri (Bean) J. & G.

Light brown, grayish below; a cream-colored band on anal; a crescentic band of cream-color crosses the nape, and continues behind the pectorals; 19 bands of cream-color, bordered with brown, from the tips of the dorsal rays to the lower half of body, becoming wider, and broken below the middle; candal tipped with pale. Head depressed; maxillary reaching to opposite posterior margin of eye; distance from ventrals to vent less than length of head. Head  $4\frac{1}{5}$ ; depth 8. D. 85; A. 67; P. 18; V. 3. Saint Michael's, Alaska. (Bean.)

(Lycodes turneri Bean, Proc. U. S. Nat. Mus. 1878, 463.)

#### 1213. L. polaris (Sabine) J. & G.

"Without any scales; length of the pectoral exceeding twice its breadth, having 15 rays. Yellowish, lighter on the belly, with 11 large saddle like markings across the back, the middle of these markings being much lighter than their edges; the whole back and the sides marbled." (Günther.) Coast of North Georgia. An imperfectly described species, unknown to late writers.

(Blennius polaris Sabine, Parry's Journ. Voy. 1819-'20, Suppl. 212: Lycodes polaris Günther, iv, 321.)

# 429.—GYMNELIS Reinhardt.

(Reinhardt, Dansk, Vidensk, Selsk, Afhandl, vii, 131, 1838; type Ophidium viride Fabricius.)

Body elongate, naked (see *G. stigma*). Vertical fins without spines; ventral fins none. Small conical teeth on the jaws, vomer, and palatines. Gill-openings very narrow. No air-bladder; pyloric cœca none; no anal papilla. Size small. Arctic seas. (γημεσε, naked; ενχελοε, eel.)

### 1214. G. viridis (Fabr.) Reinh.

Brownish, sometimes uniform, but generally with dark roundish transverse markings; 1 to 4 round black spots on anterior part of dorsal fin; anal sometimes black-edged; lower part of head with sharply-defined whitish markings. Snout subconical, longer than the eye; jaws equal; mouth oblique; maxillary reaching beyond eye; teeth rather small, conical, in a single series on each side, forming a patch anteriorly; distance from snout to vent  $2\frac{1}{3}$  times length of head. Pectoral rounded, inserted low, its length less than half that of head. Dorsal commencing over posterior third of pectorals. Head about  $6\frac{1}{2}$ ; depth about 13. Eye 7 in head. D. 100; A. 80. Arctic seas, Alaska to Nova Scotia; abundant.

(Ophidium viride Fabr. Faun. Greenl. 141, 1780; Günther, iv, 323; Collett, I. c. 123: Gymnelis pictus Günther, iv, 324, 1862.)

#### 1215. G.? stigma (Bennett.) Gthr.

Scales present, very small; no trace of ventrals. Dilute brown, with irregular transverse series of brown spots, besides obscure cross-bands ("void swathes"); a large, round, purplish spot near the origin of the dorsal. Vertical fins united into a transparent ridge; pectoral rather large. Snout obtuse; chin with a large gibbosity; teeth small. Depth about 8. L. 5 inches. Kotzebue Sound. (Lay.) Probably the type of a distinct genus.

(Ophidium stigma Lay & Bennett, Zoöl, Beechey's Voy. 67; Günther, iv, 325.)

# 430.—URONECTES Giinther.

(Giinther, Cat. Fish. Brit. Mus. iv, 325, 1832; type Ophidium parrii Ross.)

Body ensiform, compressed; tail long and tapering; ventrals none; vent not far distant from the head; numerous minute teeth in jaws and on palate; lower jaw the longer; no barbel; scales and gill-openings unknown. (6294, tail; 242745, swimmer.)

# 1216. U. parrii (Ross) Gthr.

Color uniform. Head very obtuse, its length, depth, and breadth equal; head broader than the body, flattened and grooved between the

eyes, which are lateral and rather large; greatest depth of body somewhat more than length of head; neck much arched. Dorsal inserted just behind head; pectoral extending beyond vent. Head 4. D. 50; A. 45; P. 37. Baffin's Bay. (Günther.)

(Ophidium parrii Ross, Parry's Third Voyage, App. 109; Günther, iv, 326.)

# FAMILY CXVI.—CONGROGADIDÆ.

Body elongate, compressed, eel-shaped, naked or covered with small scales. Month moderate, horizontal, the lower jaw the longer; teeth in a single series in the jaws and sometimes on vomer and palatines also; no barbels. Branchiostegals 4 to 7; gills 4, a slit behind the fourth: pseudobranchiae present. Gill-membranes more or less connected, free from the isthmus. Dorsal fin long and low, of slender rays imbedded in the skin; anal similar to dorsal, both connected to the caudal fin; tail diphycercal. Pectoral fins small; ventral fins wanting. Vent remote from the head, without papilla. Air-bladder none; pyloric cœca none. Small fishes, chiefly of the East Indies. Genera 3; species 4.

(Ophidiida, group Congrogadina Günther, iv, 388, 389.)

a. Canines present; dorsal beginning near the middle of the body... Scytalina, 431.

### 431.—SCYTALINA Jordan & Gilbert.

(Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 266; type Scutalina eerdale J. & G.)

Body very long and sleuder, covered with small scales. Head depressed, shaped like the head of a snake, with tumid checks and a distinct neck. Eyes small, superior. Mouth rather large, the lower jaw slightly projecting. Teeth conic, in single series on jaws, vomer, and palatines. Each jaw with two canines in front. No lateral line; pseudobranchiæ small. Gill-rakers almost obsolete. Dorsal fin very low, its first ray near the middle of the body. Anal fin similar to dorsal, nearly as long. Tail diphycercal, the caudal well developed. (Diminutive of Seytale, from σεοταλη, a viper.)

# 1217. S. cerdale J. & G.

Flesh-colored, with much mottling of purplish in fine pattern; belly nearly plain; caudal reddish-edged. Head broader than body; snout depressed, rounded at tip; cheeks very long; opercle short; interorbital space rather broad, concave posteriorly; eyes small, anterior and superior; upper lip separated by a crease from the skin of the forehead; lower jaw projecting; edge of lower lip with pores, and small dermal flaps and fringes; maxillary extending a little beyond eye; nostrils with small flaps. Lower jaw with a series of close-set, even,

conical teeth, besides two divergent canines in front; upper jaw with similar teeth in several series in front, the canines smaller and closer together. Pectorals little longer than eye; insertion of dorsal slightly in front of anal, a little in front of middle of body; rays of vertical fins low and weak, those of caudal most developed; vent close in front of anal, which is similar to dorsal. Head 8; depth 14. D. 41; A. 36. L. 6 inches. Straits of Fuca; burrowing among rocks near low tide-mark. (Jordan & Gilbert, Proc. U. S. Nat. Mas. iii, 1889, 266.)

# FAMILY CXVII.—FIERASFERIDÆ.

Body very elongate, compressed, tapering into a long and slender tail. No scales. Teeth eardiform on jaws, vomer, and palatines; canine teeth often present; no barbels; lower jaw included; vent at the throat; gill-membranes more or less united, free from the isthmus; no pseudobranchiæ; no pyloric cœca; vertical fins very low, confluent, without spines; no ventral fins; pectoral fins present or absent. Small fishes of the tropical seas, parasitic in shells of mollusks, in *Echinoderms*, etc. Genera 3; species 12.

(Ophidiidæ, group Fierasferina Günther, iv. 381-384.)

### 432.-FIERASFER Cuvier.

(Convier, Regne Anim. ii, 1817: type Fierasfer imberbis Cuv. = Gymnotus acus Briinnich.)
No distinct caudal fin; pectoral fins developed. (Fierasfer, the ancient name, from ψεερός, sleek and shining.)

# 1218. F. dubius\* Putnam.

Color, in spirits, uniform light brown, with a short silvery band along the sides of the abdomen, made by confluent spots. Maxillary extending slightly beyond orbit; lower teeth larger than the upper, except 2-4 front teeth of upper jaw, which are about equal to lower teeth; vomer with 3-6 teeth, 2 or 3 of these canine-like. Pectoral half head; vent under base of pectoral. Dorsal fin low, but distinct; anal much more developed than dorsal; its longest rays about in the middle of the fish. Air-bladder long, slightly constricted behind. Gill-membranes not covering isthmus. Head  $7\frac{1}{2}$ ; depth of head 15. (Putnam.) Florida Keys to Cuba and Panama.

(Carapus ? affinis Poey, Syn. Pisc. Cub. 1838, 402, not of F. affinis Günther; Putnam, Proc. Bost. Soc. Nat. Hist. 1874, 344.)

<sup>\*</sup> In the Museum of Comparative Zoölogy is "one valve of a pearl oyster, in which a specimen of Fierasfer dubius is beautifully inclosed in a pearly covering, deposited on it by the oyster." (Putnam.)

# FAMILY CXVIII.—OPHIDHDÆ.

(The Ophidioids.)

Body elongate, compressed, more or less eel-shaped, naked or covered with very small scales, which are not imbricated, but placed in oblique series at right angles with each other; head large; lower jaw included; both jaws, and usually vomer and palatines also, with villiform or cardiform teeth; premaxillaries protractile; gill-openings very wide, the gill-membranes separate, anteriorly narrowly joined to the isthmus behind the ventrals; pseudobranchiæ small or obsolete. Gills 4, a slit behind the fourth; vent more or less posterior. Vertical fins low, without spines, confluent around the tail; tail isocercal; ventral fins at the throat, each developed as a long, forked barbel. Air-bladder and pyloric cœca present. Genera 3, species about 12. Carnivorous fishes, found in most warm seas.

(Ophidiida, group Ophidiina Günther, iv, 376-380.)

a. Body scaly.

b. Palatines with a band of villiform teeth only ...... OPHIDIUM, 433.

#### 433.—OPHIDIUM Linnens.

(Ophidion Artedi; Linnaus Syst. Nat.: type Ophidion barbatum L.)

Body moderately elongate, compressed; scales small, not imbricated, but arranged in short oblique series, placed at right angles with each other, much as in Anguilla. Head naked, or somewhat scaly; teeth villiform, those of the outer series more or less enlarged; teeth on vomer and palatines bluntish, some of them enlarged. Vent well behind pectorals. (Ophidium, an ancient name, from ¿qidioz, a small snake.)

a. Onter teeth of jaws fixed. (Ophidium.)

### 1219. O. marginatum Dek.

Color nearly plain brownish; dorsal and anal fins margined with black. Maxillary reaching posterior margin of orbit; air-bladder short and broad, with a foramen on the under side; outer ray of ventrals about equalling length of head; inner ray half length of outer. Gillrakers 4. Head 6½; depth 7½. Atlantic coast of North America from New York southward.

(Dekay, N. Y. Fanna, Fish. 1842, 345; Putnam, Bost. Soc. Nat. Hist. 1874, 342.)

### 1220. O. josephi Grd.

Pale olive, sprinkled all over with brownish specks; belly and sides of head plain; vertical fins edged with black. Eye moderate, 4 in head; maxillary extending to opposite its posterior margin; origin of dorsal at some distance behind base of pectorals. Body shorter and pectorals more elongate than in *O. taylori*. Head 6. Saint Joseph's Island, Texas. (Girard.)

(Ophidion josephi Girard, U. S. Mex. Bound, Surv. Ichth. 1859, 29.)

#### 1221. O. holbrooki Putnam.

"Inner barbel nearly two-thirds length of the outer; outer barbel equal to the distance from the center of the eye to the point of the operculum; maxillary reaching to the posterior border of the eye. Length of the eye equal to the distance from its posterior margin to the ridge of the preoperculum. Head one-sixth of the total length of the fish. Dorsal and anal with a black margin. Gill-rakers 4. Air-bladder long, pointed, without a foramen." L. 6 inches. Key West, Florida. (Putnam.)

(Putnam, Proc. Bost. Soc. Nat. Hist. 1874, 342.)

# 1222. O. taylori Girard.

Light olive; head and upper parts covered with conspicuous round dark, olive-brown spots; chin dusky; vertical fins edged with black. Head large, little compressed, naked; top of head with conspicuous mucous pores. Dorsal fin beginning over the pectorals; outer ray of ventrals little more than half length of head; inner about one-third. Air-bladder ovate, not contracted; seven gill-rakers below the angle of the arch; pseudobranchiæ developed. No spine on the end of the snout. Outer teeth in both jaws considerably enlarged, the upper largest. Head 6; depth 8. L. 12 inches. Coast of California; not rare.

(Girard, U. S. Pac. R. R. Surv. Fish, 1859, 138.)

aa. Outer teeth in jaws movable; head scaly above. (Leptophidium\* Gill.)

### 1223. O. profundorum (Gill) J. & G.

Light rufous; vertical fins margined with black. Body very slender; scales regularly arranged in quincunx order; scales on head extending to forchead, opercles, and cheeks; snout high, projecting, armed with a concealed spinous hook; teeth villiform, separated by an interval from an outer row of longer, slender, movable teeth; eye longer than snout, 3½ in head; lateral line obsolete behind; vent toward end of first third

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1833, 210: type Leptophidium profundorum Gill. ( $\lambda \epsilon \pi \tau \delta \bar{\epsilon}$ , slender;  $\delta \varphi \iota \delta \iota \sigma \nu$ , Ophidium.)

of length; ventral fins short. Head 6; depth 10. Gulf Stream, off the coast of Florida. (Gill.)

(Leptophidium profundorum Gill, Proc. Acad. Nat. Sci. Phila. 1863, 211.)

# FAMILY CXX.—GADIDÆ.\*

(The Cod-fishes.)

Body elongate, more or less compressed behind; tail usually isocercal (diphycercal in *Dinematichthys*); scales cycloid, small, sometimes wanting. Gill-openings very wide; gill-membranes separated or somewhat united, commonly free from the isthmus; no spines, the fin-rays all articulated. Dorsal fin extending almost the length of the back, forming one, two, or three fins; anal fin long, single or divided; caudal fin distinct, or confluent with the dorsal and anal; ventral fins jugular, but attached to the pubic bone, each of one to eight branched rays. Gills 4, a slit behind the fourth. No pseudobranchiæ. Edge of preopercle usually covered by skin of head. Pyloric coca usually numerous, but sometimes few or none. Air bladder generally well developed. Genera 35, species about 90; an important family, many of its members being highly valued as food. They inhabit chiefly the northern seas; one genus (Lota) being confined to the fresh waters. Two genera (Stygicola, Lucifuga) are blind and inhabit the cave streams of Cuba.

(Gadidæ Günther, iv, 326-369; Ophidiidæ, group Brotulina, iv, 371-376.)

a. Paula coola
a. Body scaly.
b. Vertical fins united or approximated; pyloric cœca two; no barbel. (Brotulinæ.)
c. Vertical fins united
cc. Vertical fins separate; tail diphycereal DINEMATICHTHYS, 435.
bb. Vertical fins well separated; pyloric ceeca mostly numerous; tail isocercal.
d. Frontal bone single, normal. (Gadina.)
e. Anterior dorsal composed of a band of fringes preceded by a slender ray;
barbels 3 to 5.
f. Ventral rays 3 to 5; anal fin entireOnos, 436.
ee. Anterior dorsal composed of distinct rays.

g. Chin with a barbel.

h. Dorsal fins two; anal fin one.

ii. Ventrals broader, each of about six rays.

j. Tail attenuate; anal fin notched; mouth inferior; deep-sea fishes. HALOPORPHYRUS, 438.

ij. Tail normal; anal fin entire; mouth terminal.

kk. Vomer with teeth.

l. Vomer and mandible with canines......Molva, 440.

ll. Vomer and mandible without canines..... Lota, 441.

<sup>\*</sup>Including family 119, Brotulidæ, in the key to the families, page 79.

### 434.-BYTHITES Reinhardt.

(Reinhardt, Dansk-Vidensk, Selsk, Afhandl, vii, 178, 1838; type Bythites fuscus Reinh.) Body clongate, covered with minute scales. Head large, thick; mouth large; jaws equal; no barbel; bands of teeth in the jaws and on vomer and palatines. Branchiostegals eight; gill-membranes united, free from the isthmus; eye moderate. Lateral line interrupted. Vertical fins united; ventral fins reduced to simple filaments, each composed of two rays closely united. Air-bladder large; two pyloric cœca. A thick, conical, anal papilla (in the male). Greenland. ( $\beta 5005 \tau_{35}$ , an animal of the depths, from  $\beta 500 \omega_{5}$ , the deep.)

### 1221. B. fuscus Reinh.

Uniform dark-brown. Head with minute cirri; snont obtuse; maxillary extending to below eye; vertical fins enveloped in thick skin; ventrals two-thirds as long as head. Depth less than length of head. Greenland. (Günther.)

(Reinhardt, l. c. 179; Günther iv, 375.)

### 435.—DINEMATICHTHYS Bleeker.

(Brosmophycis Gill: Halias Ayres.)

(Bleeker, Batoë, 318; type Dinematichthys ilyocatcoides Bleeker.)

Body moderately elongate, covered with minute imbedded scales; lateral line inconspicuous; head moderate, conical; operele with a spine posteriorly; preopercle unarmed, usually with a large mucous pore at its angle; no barbels; jaws subequal; teeth in the jaws cardiform, in bands anteriorly; vomer and palatines with similar teeth; gill-membranes little connected. Dorsal fin low, continuous, its last rays contiguous to the candal, but nearly or quite free from it; anal fin even, similar to dorsal, but shorter; rays of vertical fins slender, much branched; ventrals reduced each to a filament formed of two rays

closely joined; caudal short and slender; tail diphycercal, truncate at base of caudal; anal papilla large (in  $\mathcal{E}$ ); stomach large, with two short pyloric carea. ( $\partial i \mathbf{r}$ , two;  $i \hat{\chi} \rho a \mathbf{r}$ , thread;  $i \chi \rho b \hat{\mathbf{r}}$ , fish.)

a. Head nearly or quite scaleless. (Halias\* Ayrcs.)

## 1225. D. marginatus (Ayres) Gthr.

Reddish brown; fins broadly edged with bright rose red. Head with traces of very rudimentary scales sunken in the skin; eye well forward, 1½ in snont, 7 or 8 in head; maxillary reaching beyond eye a little less than half length of head; teeth of jaws subequal, in broad bands; palatine teeth in a short band, shorter than eye. Fin-rays slender, imbedded in skin; pectorals moderate, a little more than half length of head; ventrals half length of head; nape nearer origin of dorsal than tip of snout; vent slightly behind middle of body; caudal as long as eye and snont; a conspicuous pore above tip of maxillary; two pores at chin; anal papilla without horny appendages; lower lip with a fringe of minute cirri. Head 4½ in length; depth about 6. D. about 80; A. about 65. Coast of California, rather rare; in deep water.

(Brosmius marginatus Ayres, Proc. Cal. Acad. Nat. Sci. i, 13, 1854: Halias marginatus Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 52; Günther, iv, 375: Brosmophycis marginatus Gill, Proc. Acad. Nat. Sci. Phila. 1861, 168; 1863, 253.)

# 436.-ONOS† Ayres.

# Rocklings.

(Motella Cuvier: Molrella Kaup: Rhinonemus Gill: Ciliata Couch and Conchia Thompson, young forms.)

(Risso, Hist. Nat. d'Eur. Merid. iii, 214, 1826: type Onos mustella Risso = Gadus tricirratus Bl. & Schn.)

Body rather elongate, covered with very small scales; head more or less depressed; lower jaw included; chin with a barbel; snout with two to four barbels, one on each anterior nostril; teeth in bands on jaws and vomer; none on palatines; some of the teeth in upper jaw sometimes enlarged or canine-like; dorsal fins two, the anterior composed of small fringe-like rays concealed in a groove, in front of these a single long ray; second dorsal long; anal similar; caudal fin rounded or lanceo-

<sup>\*</sup>Ayres, Proc. Cal. Acad. Nat. Sci. ii, 52, 1860: type Brosmius marginatus Ayres. ( $\check{a}\lambda \varepsilon$ , the sea.)

tWe do not adopt the earlier name Gaidropsarus of Rafinesque, because we find little evidence that the rough figure of Rondelet, on which Gaidropsarus mustellaris Rafinesque was founded, was intended for a species of Onos rather than of Phycis. Enchelyopus Bloch & Schneider is a heterogeneous group, including species of Gadus, of which genus it may be considered a synonym.

late; tail isocercal; ventral fins of 5 to 7 rays. Small fishes of the northern seas; the species differing considerably among themselves. (Onos, an ancient name of certain Gadoid fishes; from 6205, an ass.)

 a. Barbels four; head anteriorly high and compressed; no large canines. (Rhinonemus Gill.)

### 1226. O. cimbrius (L.) Goode & Bean.—Four-bearded Rockling.

Brownish, posterior part of dorsal and anal, and lower margin of caudal abruptly black; inside of mouth black. Head oblong, compressed, the snout high, its anterior profile blunt; mouth large, inferior; a barbel at chin, one at end of snout, and one on each anterior nostril; maxillary reaching much beyond eye; teeth in narrow bands, some of them considerably enlarged; lateral line stitch-like, developed at intervals. First (free) ray of dorsal as long as head; ventrals about half length of head; caudal somewhat acute. Head 5; depth 6. D. 50; A. 43; V. 5. L. 12 inches. North Atlantic, on both coasts.

(Gadus cimbrins Linnaens, Syst. Nat.: Motella candacuta Storer, Hist. Fish. Mass. 361: Motella cimbria Günther, iv, 367: Rhinonemus candacuta Gill, Proc. Acad. Nat. Sci. Phila. 1863, 241.)

ua. Barbels three. (Onos.)

# 1227. O. reinhardti (Kröyer) Gill.

Uniform reddish brown; cirri and tips of fins red. Head depressed, but rather pointed anteriorly; snout rather short, with two barbels; chin with one; teeth in villiform bands, those of one series in each jaw longer than the rest. First ray of first dorsal short, little longer than snout. Vent near middle of length. Distance from snout to first dorsal  $\frac{3}{10}$  of length. Head 5. D. 56; A. 45; V. 8. Greenland. (Collett.)

(? Motella argentata Reinh. Selsk. Nat. Math. Afh. 1837, 110: Motella reinhardti Kröyer MSS.; Collett, Norske Nord-Havs. Exp. 1850, 131: Onos reinhardti Gill, Proc. Acad. Nat. Sci. Phila. 1863, 241: ? Conchia argentata Günther, 1v, 363, the young of this or other species of Onos; small, silvery fishes, swimming at the surface in the open sea.)

### 1228. O. ensis (Reinh.) Gill.

Head small; snout with two barbels; chin with one; teeth feeble, uniform, in villiform bands; palatine teeth villiform. Vent nearly median; distance to front of dorsal  $\frac{3}{3}$  of length. First dorsal ray produced, as long as head. Head  $5\frac{3}{4}$ ; D. 59; A. 46. Greenland. (Collett.)

(Motella ensis Reinh, Dansk, Vidensk, Selsk, Nat. vii, 115, 1838; Onos ensis Gill, Proc. Acad. Nat. Sci. Phila, 1863, 241; Collett, I. c. 134.)

#### 437.-PHVCIS\* Bloch & Schneider.

### Codlings.

(Bloch. & Schneider, Syst. Ichth. 1801, 56: type Phycis tinca Bloch & Schneider.)

Body rather elongate; head subconic; mouth rather large, the maxillary reaching to below eye; lower jaw included; chin with a small barbel; jaws and vomer with broad bands of subequal, pointed teeth; palatines toothless. Dorsal fins two, the first sometimes produced at tip; second dorsal long, similar to the anal. Ventrals wide apart, filamentons, each of 2 or 3 slender rays. Gill-membranes somewhat connected, narrowly joined to the isthmus.  $(\varphi \tilde{\nu}ziz$ , an ancient name of some fish living in the Fucus,  $\varphi \tilde{\nu}zoz$ .)

a. Dorsal rays scarcely produced. (Urophycist Gill.)

# 1229. P. regius (Walb.) J. & G.

Pale brownish tinged with yellowish, the lateral line dark brown, interrupted by white spots; inside of mouth white; first dorsal largely black, this color surrounded by white; second dorsal olivaceous, with irregular round dark spots; caudal, anal, and pectorals dusky; ventrals and lower edge of pectorals white; two vertical series of round dark spots on the sides of the head. Body rather stout; head broad; mouth large, the maxillary reaching posterior margin of eye. Eye less than snont or interorbital width; first dorsal low, its height about equal to half length of head; ventral fin longer than head, about 3½ in length of body; caudal fin subtruncate. Head 4½; depth 4½. D. 8–43; A. about 45; scales rather large, about 90 in the lateral line. North Atlantic, south to Cape Fear. Said to exhibit electric powers in life.

(Blennius regius Walb. Art. Pisc. 1792, 183: Phycis punctatus Dek. N. Y. Fauna, Fish. 292: Enchelyopus regalis Bloch. & Schn. 1801, 53: Phycis regalis Günther, iv, 355.)

#### 1230. P. carlli Bean.

Brown, with some light spots on the second dorsal fin and on the sides; anal and both dorsals margined with brown. Body short and stout; maxillary extending beyond front of eye; barbel one-third length of upper jaw, which is half length of head; interorbital space equal to length of snout; pectorals as long as postorbital part of head;

<sup>\*&</sup>quot; Hypsiptera argentea" Günther (ii, 376; iv, 362); a very small silvery fish, occasionally taken on our coasts as well as on those of Enrope, is now supposed to be the young of species of Physis.

<sup>+</sup>Gill, Proc. Acad. Nat. Sci. Phila. 1863, 240: type Gadus regius Walb. ( $ov\rho\dot{\alpha}$ , tail;  $\phi\ddot{v}nis$ , Phycis.)

ventrals reaching nearly to vent; none of the rays of first dorsal produced, the fin not higher than second dorsal. Head 3; depth 4; D. 10-62; A. 53; P. 15; Lat. l. 155. L. 14 inches. Charleston, South Carolina.

(Bean, Proc. U. S. Nat. Mus. iii, 69, 1880.)

aa. One of the rays of the first dorsal more or less produced. (Phycis.)

### 1231. P. chuss (Walb.) Gill.—Codling; Squirrel-hake.

Brownish above, sides lighter and tinged with yellowish; thickly punctulate with darker; below pale; inside of mouth white; vertical fins somewhat dusky; anal fin margined with pale; lateral line not dark. Body rather slender; head depressed; eye large, about equal to interorbital width; maxillary reaching posterior margin of pupil. Filamentons dorsal ray about two-sevenths length of body, when perfect; pectorals  $\frac{4}{5}$  length of head; ventral fins extending beyond the vent; scales comparatively large. Head  $4\frac{1}{2}$ ; depth 5. D. 9–57; A. 50; Lat. l. 110. Atlantic coast, chiefly northward.

(Blennius chuss Walb. Art. Pisc. 1792, 186; Enchelyopus americanus Bl. & Schn. 1801, 53; Phycis americanus Giinther, iv, 353; Phycis filamentosus Storer, Fish. Mass. 367; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 237.)

# 1232. P. tenuis (Mitch.) Dek.—Codling; White hake; Squirrel-hake.

Brownish, lighter and yellowish below; fins very dark. Snout longer than eye, narrower and more pointed than in *P. chuss*. Eye large, usually wider than interorbital space; maxillary reaching beyond pupil. Filamentons dorsal ray about two-thirds length of head; ventral fins about reaching vent. Scales very small. Head 4½; depth 5½. D. 9–57; A. 48; Lat. l. 138. Distinguished from the preceding chiefly by the smaller scales. North Atlantic, south to Virginia; abundant northward.

(Gadus tenuis Mitch, Trans. Lit. & Phil. Soc. N. Y. 1815, 372; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 238; Physis dekayi Kanp, Archiv. Naturg. i, 89, 1858.)

#### 1233. P. chesteri Goode and Bean.

Eye 3\frac{1}{3} in length of head; maxillary twice in head; barbel one third diameter of orbit; vent equidistant from tip of snout and end of second dorsal; distance from snout to dorsal fin equals twice the length of the mandible; the third ray of the second dorsal extremely elongate, its length more than twice that of head, and more than four times that of the longest of the other rays; ventral fins with the first ray one-third length of body, the second about three times the length of the head,

the third shorter than the diameter of orbit; pectorals four times as long as the opercle. Scales large and thin; lateral line much broken posteriorly. Head 4½; depth 5. D. 9 or 10, 56; A. 56; Lat. 1. 90. (Goode and Bean.) Coast of Massachusetts, in deep water.

(Goode and Bean, Proc. U. S. Nat. Mus. i, 1878, 256.)

### 438.-HALOPORPHYRUS Günther.

(Lepidion Swainson; preoccupied as Lepidia.)

(Günther, Cat. Fish. Brit. Mus. iv, 358, 1862: type Gadus lepidion Risso.)

Body elongate, compressed, tapering into a slender tail. Scales very small. Head entirely scaly, even to the gill-membranes. Snout depressed, thin and flat, projecting beyond the mouth; mouth rather large; chin with a barbel; jaws with bands of villiform teeth; a small roundish patch of teeth on vomer, none on palatines. Dorsal fins two; the first short, its anterior ray produced into a long filament; anal fin deeply notched, almost separated into two fins; ventral fins with six rays, one of them filamentous; candal truncate. Branchiostegals 7. Deep-water fishes. ( $\delta\lambda z$ , sea;  $\pi op \varphi v \rho o z$ , purple, from the deep coloration.)

#### 1233. II. viola Goode & Bean.

Color, deep violet or blue-black; inside of mouth and opercles blue-black; snout broad, pointed at tip, much depressed, forming a roof-like projection above mouth; a conspicuous keel extending backward from tip of snout along the suborbital to the posterior margin of the eye. Mouth U-shaped, wholly inferior; maxillary nearly reaching posterior margin of orbit; interorbital space flat, as wide as the large eye, the orbital ridges somewhat elevated; barbel about one-half diameter of orbit. First dorsal with its first ray much produced, longer than head; anal fin deeply notched near its middle. Candal peduncle as long as eye; its depth more than half its length; longest ray of ventrals reaching about half way to vent; pectoral 1½ in head. Head 4½; depth 5. D. 4–53; A. 40; V. 6; Lat. l. 115. Banks of Newfoundland and southward, in deep water..

(Haloporphyrus viola Goode and Bean, Proc. U. S. Nat. Mus. i, 256, 1878.)

### 439.-PHYSICULUS Kaup.

(Kaup, Wiegmann's Archiv. 1858, 88; type Physicalus dalwigkii Kaup.)

Body elongate, covered with small scales; head entirely scaly; snout broad, obtusely rounded, projecting beyond the mouth; mouth of mod-

 $2\frac{2}{5}$ . D. 81; A. 63; Lat. l. 53 (Lat. l. 70, Günther). West Florida to Cuba; abundant in deep water.

(Pleuronectes aramaca Cuvier, Règne Anim.: Hemirhombus oramaca Gthr. iv, 422: ? Hemirhombus fuscus Poey, Syn. Pisc. Cub. 1868, 406.

aa. Teeth in both jaws in single series (Citharichthus).

### 1257. C. sordidus (Grd.) Gthr.

Dull olive brownish of varying shade, the males with dull orange spots and blotches; each scale with a darker edge; dorsal and anal fins in the male blackish, with dull orange blotches, and edged anteriorly with yellowish; female paler, the fins nearly plain. Form elliptical; interocular space concave, scaly, a conspicuous sharp ridge above the lower eye; mouth not large, the maxillary about 3 in length of head; teeth anteriorly subequal, growing much smaller behind. Gill-rakers about 16 below the angle. Lower pharyngeals narrow, each with one row of slender teeth. Scales rather large, thin, and membranaceous, readily deciduous, their edges slightly ciliate; accessory scales numerous. Eye large, much longer than snout,  $3\frac{1}{2}$  in head; depth of caudal peduncle less than one-third head; pectorals long, nearly two-thirds length of head. Head  $3\frac{3}{2}$ ; depth  $2\frac{1}{3}$ . D. 95; A. 77; Lat. l. 70. Coast of California north, to Vancouver Island; very abundant; a small, soft-fleshed, dull-colored species.

(Psettichthys sordidus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 142; Günther, iv, 421; Lockington, Proc. U. S. Nat. Mus. 1879, 83: Metoponops cooperi Gill, Proc. Acad. Nat. Sci. Phila. 1864, 198: Orthopsetta sordida Gill.)

### 1258. C. spilopterus Günther.

Olive brownish, usually with large blotches of darker; a series of distant, obscure, blackish blotches along the basal portions of the anal and dorsal fins. Body ovate. Mouth small, very oblique, the gape curved; maxillary  $2_3^2$  times in length of head, reaching beyond middle of orbit; snout projecting; eyes small, even, shorter than snout, about 6 in head, separated by a narrow ridge, which is concave and scaleless anteriorly; teeth all small; front teeth of upper jaw wide-set, much larger than the posterior, which are close together and very small; teeth of lower jaw few, wide apart. Gill-rakers short and strong, 13 below angle. Pectorals short, less than half length of head. Scales large, those on middle of sides posteriorly largest. Head  $3_2^1$ ; depth  $2_{10}^1$ . D. 80; A. 61; Lat. 1. 45. Size small. Tropical America, north to Florida and Louisiana (here described from specimens obtained at Panama).

(Günther, iv, 421; Günther, Trans. Zoöl. Soc. Lond. 1866, 471: Citharichthys microstomus Gill, Proc. Acad. Nat. Sci. Phila. 1864, 223.)

Bull. Nat. Mus. No. 16—52

### 1259. C. arctifrons Goode.

Light brown. Body comparatively elongate. Scales cycloid, decidnons. Lateral line sharply defined, straight. Eye 4 in head; interorbital space very narrow, its width 4 in snout; maxillary  $3\frac{1}{2}$  in head. Dorsal fin beginning above front of upper eye, its greatest height more than half the length of the head; anal beginning below axil of pectoral; candal triangular, subsessile, as long as head; rays of vertical fins all much exserted; pectorals inserted very low, that of the colored side being twice the length of the other. Head 4; depth  $2\frac{1}{2}$ . D. 83; A. 67; P. 10 (left), 7 (right); Lat. I. 40. L. 6 inches. Gulf Stream, off the coast of Rhode Island; abundant. (Goode.)

(Goode, Proc. U. S. Nat. Mus. 1880, 341.)

### 1260. C. unicornis Goode.

Ashy gray, with dark lateral line; eyes black. Body comparatively deep, its greatest height over the pectorals. Scales thin, deciduous. Eye 3 in head, equal to snout, and more than twice the interorbital space, which has a strong ridge; maxillary less than half length of head; teeth minute, close-set, in a single series, stronger on the blind side. A strong, sharp spine on the snout at the anterior termination of the ridge at lower margin of upper eye. Highest rays of dorsal half length of head; caudal pointed, triangular, subsessile; pectoral of left side twice as long as the eye, not half longer than right pectoral. Head 4; depth 2. D. 74; A. 60; P. 4 (right), 10 (left); Lat. I. 40. L. 3 inches. Gulf Stream, off the coast of Rhode Island. (Goode.) (Goode, Proc. U. S. Nat. Mus. 1880, 342.)

### 451.-HIPPOGLOSSUS Cuvier.

### Halibut.

(Cuvier, Règne Anim. ii, 1817: type Pleuronectes hippoglossus L.)

Eyes and color on the right side. Form oblong, not strongly compressed. Mouth wide, oblique; teeth in the upper jaw in two series, those below in one; anterior teeth in upper jaw, and lateral teeth in lower, strong; no teeth on vomer or palatines; lower pharyngeal teeth in two rows. Dorsal fin beginning above the eye, its middle rays elevated, the posterior rays of dorsal and anal bifid; candal fin lunate; ventral fins both lateral. Scales very small, cycloid; lateral line with a strong curve in front. Gill-rakers few, short, compressed, wide-set-Vertebra 16 + 34. Largest of the flounders; the single species abound-

ing in the Northern seas. (The ancient name, from  $l\pi\pi o z$ , horse;  $\gamma \lambda \tilde{\omega} \sigma \sigma a$ , tongne.)

### 1261. H. vulgaris Fleming,-Halibut.

Nearly uniform dark brown; blind side white. Body comparatively elongate, not strongly compressed, deep mesially, thence rapidly tapering each way; head broad; eyes large, separated by a very broad flattish area; lower eye slightly advanced; month large, the maxillary reaching middle of orbit. Head 3\frac{3}{4}; depth 3. D. 105; A. 78. In all Northern seas, south to France, Cape Cod, and San Francisco. One of our most important food-fishes, reaching a weight sometimes of 400 pounds.

(Pleuronectes hippoglossus L. Syst. Nat.; Fleming, Brit. Anim. 1828, 197; Günther, iv, 403: Hippoglossus americanus Gill, Proc. Acad. Nat. Sci. Phila. 1864, 220.)

#### 452.—PLATYSOMATICHTHYS Bleeker.

(Reinhardtius Gill.)

(Bleeker, Comptes Rendus Acad. Sci. Amsterd. xiii, 1862: type Pleuronectes pinguis Fabricius = Pleuronectes hippoglossoides Walbaum.)

Eyes and color on the right side. Body more or less elongate, compressed; head long and large; mouth large; maxillary reaching beyond eye; jaws with strong, unequal teeth; the upper with 2 series in front, these converging behind; lower jaw with a single series of strong, distant teeth; no teeth on vomer or palatines. Gill-rakers few, short, stout, and rough. Fins rather low; caudal fin lunate. Lower pharyngeal teeth in 1 row. Scales small, cycloid; lateral line without anterior curve. One species known.  $(\pi \lambda a \tau v z, \text{ flat}; \sigma \tilde{\omega} \mu a, \text{ body}; i \chi \theta \dot{\nu} z, \text{ fish.})$ 

### 1262. P. hippoglossoides (Walbaum) Bean,—Greenland Halibut.

Yellowish brown. Snout more than twice as long as the orbit, the diameter of which is one-eighth the length of the head; eyes even in front; interorbital space flat, scaly, wider than the orbit; lower jaw prominent; length of maxillary 2½ in head; teeth conical, pointed; upper jaw with 2 series, convergent posteriorly; those of the outer series gradually smaller posteriorly; a pair of strong canine teeth anteriorly in the inner series, the other teeth of this series being very small; lower jaw with a series of strong, distant teeth. Gill-rakers short, thick, and strongly dentate. Fins naked. Longest dorsal rays one-third length of head; no anal spine; dorsal and anal rays all simple, the dorsal beginning over posterior third of the eye. Scales

very small, not ciliated. Head 4; depth 3. D. 100; A. 75. Greenland to Cape Cod, common northward, reaching a very large size.

(Pleuronectes hippoglossoides Walbaum, Artedi, Pisc. 1792, 115: Hippoglossus grænlandicus Günther, iv, 404.)

### 453.—ATHERESTHES Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mns. 1880, 51: type Platysomatichthys stomias J. & G.)

Eyes and color on the right side. Body very long and slender, closely compressed, tapering into a long and slender caudal peduncle; head clongate, narrow; mouth extremely large, oblique, the long and narrow maxillary extending beyond the eye; both jaws with 2 irregular series of sharp, unequal, arrow-shaped teeth, some of them long and wide-set, the others short and close-set, sharp; the long teeth freely depressible. Gill-rakers numerous, long, slender and stiff, strongly dentate within. Scales rather large, thin, and readily decidnous, slightly ciliated; those on the blind side similar, smooth; lateral line without arch. Fins low and fragile. Dorsal commencing over the eye, its anterior rays low, the posterior rays somewhat forked; no anal spine; pectorals and ventrals small, both of the latter lateral; caudal lunate.  $(a\theta\eta\rho, \text{arrow}; o\delta\omega\nu, \text{tooth}; \text{ from the arrow-shaped teeth.})$ 

# 1263. A. stomias Jordan & Gilbert.

Plain olive brown, the margins of the scales darker; blind side dusted with black points. Head long, the snout protruding, somewhat truncate at tip; mouth excessively large; the maxillary more than half the length of the head, and reaching behind the eye; teeth in upper jaw anteriorly in a single series, long, slender, and wide-set, much smaller and closerset behind; on sides of jaw the teeth are very small, and in 2 distinct series, the inner of which corresponds to the single series in front, the teeth thus gradually increasing in size forwards; teeth in inner series of lower jaw very sharp and slender, longer than the upper teeth, wideset, alternating with shorter, depressed teeth; outside of these larger teeth is a series of fixed small teeth; all of the long teeth in both jaws depressible and conspicuously arrow-shaped towards their tips; inner series of small teeth in upper jaw also arrow-shaped, depressible; eye large,  $4\frac{3}{4}$  in head; interorbital space scaly, ridged, not a third the width of the eye. Gill-rakers long and strong, about 17 in number (in total), the longest more than half the diameter of the eye. Upper eye with its range entirely vertical. Scales extremely thin, irregular in size, not

evenly imbricated; lateral line very prominent. Dorsal fin beginning just behind the middle of the eye; caudal pedancle nearly as long as the pectoral fin, about two-fifths the length of the head. Head  $3\frac{3}{5}$ ; depth  $3\frac{1}{3}$ . D. 103; A. 86; Lat. l. 135. San Francisco to Alaska, in deep water; reaching a length of 2 feet.

(Platysomatichthys stomius Jordan & Gilbert, Proc. U. S. Nat. Mus. 1850, 301.)

### 454.-PARALICETHYS Girard.

(Pseudorhombus Bleeker: Ancylopsetta, Chanopsetta, and Uropsetta Gill: Xystreurys
J. & G: Hippoglossina Steindachuer.)

(Girard, U. S. Pac. R. R. Surv. Fish. 1858, 146: type Paralichthys maculosus Girard.)

Eyes and color on the left side (except in Paralichthys maculosus and Paralichthys liolepis, reversed examples of which species are about as common as sinistral ones). Body oblong; mouth large, oblique; each jaw with a single row of usually slender and sharp teeth, which are more or less enlarged anteriorly; no teeth on vomer or palatines. Gillrakers various. Scales small, etenoid or cycloid; lateral line simple, with a strong curve anteriorly. Dorsal fin beginning above or before the eye; both ventrals lateral; caudal fin double truncate, or double concave, its middle rays produced; no anal spine. Species numerous, found in all warm seas.  $(\pi a \rho a \lambda \lambda \epsilon \lambda \sigma z, parallel; i \chi \theta \dot{\sigma} z, fish.)$ 

## 1264. P. californicus (Ayres) J. & G.-Monterey halibut; Bastard halibut.

Grayish brown, uniform, or mottled with blackish and pale, the head sometimes sprinkled with black dots; young brownish, with bluish spots. Body rather long and thickish; head small; eye small, little wider than the broad, flattish interorbital space; maxillary as long as pectoral, half length of head, reaching beyond eye; teeth slender, sharp, rather long, the canines moderate. Scales small, finely ciliate, each scale surrounded by narrow, accessory scales; scales on blind side similar; fins with etenoid scales. Dorsal low, beginning over front of upper eye. Gill-rakers very long and slender, numerous, as long as eye, 23 below the angle. Lower pharyngeals narrow, with small, slender teeth. Anal spine small, concealed. Head  $3\frac{3}{4}$  to  $4\frac{1}{4}$ ; depth  $2\frac{2}{3}$ . D. 70; A. 55; Lat. l. 100. Body indifferently dextral or sinistral. Coast of California; abundant southward; an important food-fish, reaching a weight of 60 pounds.

(Paralichthys maculosus Girard, Proc. Acad. Nat. Sci. Phil. 1854, 147, young (not Rhombus maculosus Cuvier, which is also a species of Paralichthys): Paralichthys maculosus Girard, U. S. Pac. R. R. Surv. Fish. 147: Paralichthys maculosus Giinther, iv, 431: Hippoglossus californicus Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 29: Paralichthys maculosus and Uropsetta californica Gill, Proc. Acad. Nat. Sci. Phil. 1864, 197: Pseudorhombus californicus Giinther, iv, 426.)

### 1265. P. ophrvas J. & G. (sp. nov.)

Color brownish gray, mottled with darker; fins dusky, with round, Body moderately elongate, thickish; mouth not very large, oblique; each jaw armed with a single row of large, sharp, wideset teeth, the front teeth enlarged and canine-like, about 8 on each side of lower jaw; lateral teeth of upper jaw minute, close-set; chin prominent; maxillary not reaching beyond eye, scarcely half length of head. Diameter of eye about equal to length of shout, 51 in head. Dorsal fin low, beginning over front of eye, its first rays about 5 in head: anal spine obsolete. Gill-rakers rather long and slender, 5 + 14 in number, the longest two-thirds eye, 33 in maxillary, their length 4 to 5 times their breadth at base. Scales very small, not etenoid, with few accessory smaller ones; curve of lateral line 41 in straight part. Interorbital space a rather narrow bony ridge, anteriorly naked, not wider than pupil (in specimen 8 inches long), the ridge extending backward, forming a conspicuous elevated rim behind upper eve. Pectoral about half length of head; caudal \(\frac{1}{2}\). Head 3\(\frac{3}{2}\); depth 2\(\frac{1}{2}\). D. 88; A. 67; Lat. l. 90. One specimen known; from Charleston, S. C.

### 1266. P. dentatus (L.) J. & G.—Common flounder.

Blackish olive, mottled and blotched with darker; fins similarly marked, the pectorals more or less distinctly barred. Body oblong, moderately compressed; mouth wide, oblique, the mandible very heavy and much projecting; 8 to 10 teeth on each side of lower jaw, the two anterior teeth very long; anterior teeth of upper jaw strong, but smaller than those in the lower jaw; the lateral teeth very small and close-set. Eyes small, shorter than snout, about one sixth length of head, and in the adult as wide as the broad, flattish, scaly, interorbital area; the latter is much narrower in the young. Scales small, cycloid; accessory scales few. Gill-rakers lanceolate, dentate, stoutish, wide-set, much shorter than eye, the longest 23 times as long as broad at base, 53 in in maxillary, about 2+10 in number; pectoral fin about as long as maxillary, which extends beyond eye, and is rather more than half length of head. Dorsal low, its anterior rays somewhat exserted, but short; candal double concave, the middle rays produced. Anal spine Fins all scaly. Head  $3\frac{2}{3}$ ; depth  $2\frac{1}{3}$ . D. 88 obsolete; ventrals small. (85 to 93); A. 66 (65 to 73); Lat. l. about 100. New England to Texas and West Indies; everywhere one of the commonest species.

(Pleuroneetes dentatus L. Syst. Nat. i, 458: Platessa ocellaris Dekay, New York Fauna, Fish. 1842: Pseudorhombus dentatus and P. ocellaris Günther, iv, 425-430: Chænopsetta

ocellaris Gill, Proc. Acad. Nat. Sci. Phil. 1864, 218: Pleuronectes melanogaster Mitchill, Trans. Lit. and Phil. Soc. N. Y. (doubled example): Platessa oblonga Dekay, New York Fauna, Fish. 1842, 299, pl. 48, f. 156, not Pleuronectes oblongus Mitch.: Pseudorhombus oblongus Günther, iv, 426: Pseudorhombus deutatus Goode & Bean, Proc. U. S. Nat. Mus. 1879, 123.)

### **1267. P. albigutta** J. & G.

Dark olive, mottled with dusky, and marked by numerous more or less distinct pale spots, which are sometimes obsolete. Body moderately elongate, elliptical; mouth large, the maxillary reaching past lower eye, its length half head; teeth rather strong, slender, about 7 on each side of lower jaw; 3 or 4 moderate canines in front of upper jaw; the lateral teeth being minute, close-set; interorbital space narrow, scaled posteriorly, the upper ridge prominent behind upper orbit; eye  $5\frac{3}{4}$  in head. Gill-rakers broad, the longest  $2\frac{1}{2}$  in eye; about 10 below angle. Fins low; anterior rays of dorsal not elevated nor exserted; the longest rays behind the middle,  $2\frac{3}{4}$  in head; caudal rounded,  $1\frac{1}{3}$  in in head. Scales moderate, cycloid. Lateral line with a high curve, its length  $3\frac{1}{3}$  in straight part. Head  $3\frac{1}{3}$ ; depth  $2\frac{2}{5}$ . D. 77 (75 to 80); A. 60 (59 to 61); Lat. l. 90 (pores). South Atlantic and Gulf coast, rather common; readily distinguished from P. dentatus, by the smaller number of fin rays.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

### 1268. P. squamilentus J. & G.

Brownish; body and fins spotted with darker; candal mottled with white; pectorals banded, with dark spots. Body deep, strongly compressed; caudal peduncle very short. Head wide, the eyes large, wide apart. Month very large, oblique, the broad maxillary reaching well beyond pupil, its length more than half the head. Lower jaw projecting; teeth few, unequal, in a single row, about 8 in each jaw canine-like, the two in front of lower jaw longest; lateral teeth of upper jaw minute. Interorbital space flat, scaly, nearly as broad as eye. Scales very small, smooth, adherent; curve of lateral line  $4\frac{1}{3}$  in straight part. Gill-rakers short, 3+9 in number, triangular, roughly toothed, little higher than wide, the longest nearly half eye. Dorsal beginning over front of eye, the anterior rays  $4\frac{1}{2}$  in head; pectoral short, shorter than maxillary. Anal spine obsolete. Caudal double-rounded. Head  $3\frac{1}{5}$ ; depth 2. D. 78; A. 59; Lat. l. 123 (pores). West coast of Florida to South Carolina.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

### 1269. P. oblongus\* (Mitch.) J. & G.

Gravish, thickly mottled with darker and somewhat translucent: four large, horizontally-oblong, black ocelli, each surrounded by a pinkish area; one just behind middle of the body below the dorsal. one opposite this above anal; two similar smaller spots below last rays of dorsal and above last of anal. Body comparatively elongate. strongly compressed. Eyes large, nearly 4 in head, separated by a prominent narrow, sharp ridge. Upper jaw with very numerous small, closeset teeth laterally, and 4 or 5 canines in front; the lateral teeth abruptly smaller than the anterior; each side of lower jaw with 7 to 10 teeth. Chin prominent. Maxillary narrow, reaching past middle of pupil, 21 in length of head. Gape curved. Scales weakly etenoid or eycloid. Gill-rakers thick, rather long, few, about 8 below angle. Dorsal low, beginning over front of eye, some of the anterior rays exserted, but not elongate; the longest rays behind middle of fin, not quite half head. Caudal  $1\frac{1}{4}$  in head; pectoral  $1\frac{3}{5}$ . Anal spine obsolete. Head 4; depth  $2\frac{1}{4}$ . D. 72; A. 60; Lat. l. 93. (D. 79; A. 59, according to Mitchill; D. 86; A. 76, according to Storer). Atlantic coast, northward; not abundant. (Pleuronectes oblongus Mitchill, Trans. Lit. and Phil. Soc. i, 391, 1815: Platessa quad-

(Pleuronectes oblongus Mitchill, Trans. Lit. and Phil. Soc. i, 391, 1815: Platessa quadrocellata Storer, Proc. Bost. Soc. Nat. Hist. 1847, 242, and in Hist. Fish. Mass. 397, pl. XXXi, f. 3.)

# 1270. P. ommatus Jor. & Gilb. nom. sp. nov.

Brownish olive, with four large, oblong, occllated spots, the first above the arch of the lateral line; the three posterior forming an isosceles triangle, the hindmost being on the lateral line. Body oval, compressed, very deep; an abrupt angle above eye. Mouth very small, the maxillary reaching to below middle of orbit,  $2\frac{1}{2}$  in length of head; teeth comparatively small, about 14 on each side of lower jaw; no

<sup>\*</sup>A specimen in our collection from Wood's Holl, Mass., provisionally referred to this species, shows the following characters:

Brownish, somewhat mottled, without traces of ocelli (possibly faded); fins similar. Body rather elongate, slenderer than in other species and more compressed; mouth rather large, oblique, the lower jaw not projecting, the maxillary  $2\frac{1}{5}$  in head, reaching to opposite posterior border of pupil; about 12 teeth on each side of lower jaw, the anterior rather long, about equal to anterior teeth of upper jaw; lateral teeth of upper jaw becoming gradually smaller posteriorly, much larger, less numerous, and more widely set than in other species of this genus. Eyes large, longer than snout, 4 to  $4\frac{1}{2}$  in head, separated by a narrow, elevated, bony ridge, narrower than pupil; anteriorly scaleless, and curved behind the upper eye posteriorly. Scales moderate, cycloid, rather thin; curve of lateral line  $4\frac{3}{4}$  in straight part. Gill-rakers 2+8 in number, rather long and slender, about  $4\frac{1}{2}$  in maxillary. Dorsal beginning above middle of eye, its anterior rays not longer than others; the middle rays a little longer than longest of anal, which are about half head; caudal as long as head; anal spine obsolete; ventrals small; pectoral  $1\frac{5}{4}$  in head. Head  $4\frac{1}{6}$ ; depth  $2\frac{3}{6}$ . D. 77; A. 63; Lat. 1. 90. L. about 14 inches.

strongly differentiated eanines in either jaw. Eyes moderate, separated by a very narrow, sharp, sealy ridge. Gill-rakers very short, thick, few in number; about 8 below angle, the longest less than one-half diameter of pupil. Scales rather small, very strongly etenoid, those on blind side also rough; curve of lateral line rather low. Dorsal beginning in front of pupil, its anterior rays long and filiform, much exserted, the third ray half head; caudal short and rounded,  $1\frac{\pi}{7}$  in head; ventral fin of colored side elongate, as long as pectoral, half length of head. Anal spine wanting. Head  $3\frac{\pi}{3}$ ; depth  $1\frac{\pi}{3}$ . D. 70; A. 55; Lat. l. about 85. South Atlantic and Gulf coasts; not common.

(Aucylopsetta quadrocellata Gill, Proc. Acad. Nat. Sci. Phila. 1864, 224, not Platessa quadrocellata Storer, which is also a species of Paralichthys: Pseudorhombus quadrocellatus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 370.)

# 1271. P. liolepis Jor. & Gilb.

Color olive brown, mottled with darker; sometimes with very distinct round black blotches; vertical fins blotched with dark; pectoral of colored side with oblique bars. Body elliptical ovate, broad and compressed, its curves regular; mouth small, very oblique, the lower jaw included; maxillary reaching about to pupil, 23 in head; eyes rather large, 43 in head, separated by a very narrow, blunt scaly ridge; teeth small, conical, blunt, in a single row; those in lower jaw subequal, close-set; those upper jaw more distant, decreasing in size backwards; Gill-rakers very short, broad, and strong, minutely serrate on inner margin, about seven below angle, the longest scarcely one-fourth as long as the eye. Scales small, oblong, cycloid, the smaller accessory scales extremely numerous; branchial arches and skin of the shoulder girdle with small, cup-shaped, tubercular scales. rather high, firm, low in front, highest near the middle of the body; caudal peduncle very short and deep, its depth 4 times its length. Pectoral of eyed side falcate, usually much longer than head, its length varying considerably. Anterior nostril of blind side with a long flap. Head  $3\frac{1}{5}$ ; depth  $1\frac{5}{6}$ . D. 80; A. 62; Lat. l. 123. L. 15 inches. of Southern California; indifferently dextral or sinistral.

(Xystreurys\* liolepis Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 34.)

# 455.—HIPPOGLOSSOIDES Gottsche.

(Psettichthys Girard: Pomatopsetta Gill.)

(Gottsche; Wiegmann's Archiv. 1835, 168: type Hippoglossoides limanda Gottsche = Pleuronectes platessoides Fabricius.)

Eyes and color on the right side (except sometimes in *H. elassodon*).

<sup>\*</sup>Jordan & Gilbert l. c.: type X. liolepis J. & G. (ξυστρον, raker; ευρυς, wide.)

Body oblong, moderately compressed; mouth rather large, with one row of sharp teeth on each jaw, besides which, in the upper jaw, is often an inner row of small teeth; no teeth on vomer or palatines; gill-rakers rather long and slender; scales ctenoid; lateral line nearly straight, simple, or with an accessory dorsal branch. Dorsal fin low in front, beginning over or before the eye; ventrals both lateral; caudal double truncate, produced behind. Species found in the Northern seas.  $(i\pi\pi\sigma\gamma\lambda\omega\varsigma\varsigma\sigma\varsigma$ , Hippoglossus;  $\varepsilon\iota\delta\sigma\varsigma$ , resemblance.)

a. Lateral line simple; dorsal beginning above eye.
 b. Upper jaw with one series of teeth. (Hippoglossoides.)

### 1272. II. platessoides (Fabricius) Gill.—Rough Dab.

Reddish brown, nearly plain. Body ovate; month moderate, oblique; maxillary narrow, reaching to below pupil,  $2\frac{9}{3}$  in length of head; teeth rather small, conical, larger anteriorly, in one row in each jaw, those in the lower largest. Eyes rather large, the upper longer than snout,  $4\frac{1}{3}$  in head; lower jaw included, but with a projecting knob at the chin. Snout thick, scaly; interorbital space narrow, with a raised, obtuse ridge, entirely covered with rough scales in about 6 series; mandible with a series of scales. Gill-rakers rather short and robust, not toothed, about ten below angle; longest raker less than one-third length of eye; fins with small, rough scales; a strong pre-anal spine; pectoral not quite half length of head. Head  $3\frac{3}{4}$ ; depth  $2\frac{1}{2}$ . D. 88 (80 to 93); A. 70 (64 to 75); Lat. l. 90 (pores). North Atlantic; abundant northward on both coasts. Southern specimens (var. limandoides) have, as a rule, a smaller number of fin-rays than northern specimens.

(Pleuronectes platessoides Fabricius Fauna Grænlandica, 1780, 164: Pleuronectes limandoides Bloch. Ausl. Fische, iii, 24, tab. 106: Pomatopsetta dentata Gill, Proc. Acad. Nat. Sci. Phila. 1864, 217: Hippoglossoides limandoides Günther, iv, 405: Hippoglossoides dentatus Günther, iv, 406; Collett, Norske Nord-havs. Exp. Fiske, 1880, 144.)

#### 1273. H. elassodon Jor. & Gilb.

Brownish, nearly uniform, sometimes spotted with darker; fins grayish, irregularly blotched with dusky. Body oblong-elliptical; caudal peduncle about as long as deep; mouth rather large, the gape curved; lower jaw projecting, with a symphyseal knob; maxillary narrow, reaching beyond middle of pupil,  $2\frac{1}{2}$  in head; teeth small, close-set, nearly uniform, in a single row. Gill-rakers slender, smooth, about 16 below arch, the longest nearly half diameter of orbit. Eyes large, separated by a narrow, knife-like ridge, which is naked or with a single series of scales. Scales small, firm, rough, those on tail roughest, those

on blind side similar, mostly smooth anteriorly. Anal preceded by a spine; caudal long; pectoral of eyed side half length of head; ventral reaching past front of anal; pectoral and ventral of eyed side with prickle-like scales. Head 3½; depth 2½. D. 77-84; A. 59-64; V. 6; scales 45-100-40. L. 18 inches. Body sometimes sinistral. Puget Sound to Alaska; rather common. Very closely allied to the preceding species.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 278.)

aa. Upper jaw with 2 rows of teeth.

c. Scales small, firm.

# 1274. H. jordani Lockington.

Olive brown, nearly uniform; membrane of dorsal and anal fins elouded with darker. Body broadly elliptical. Dorsal and ventral outline equally and regularly curved. Mouth oblique, the jaws about even, the symphyseal knob but little projecting; gape curved; maxillary broad, reaching to behind pupil, 23 in head; teeth in 2 series in the upper jaw, the inner series small and distant from the outer, which is considerably enlarged in front; lower jaw with a single series similar to the outer series in the upper jaw, but larger. Gill-rakers roughish, strong, about 15 below angle, the longest about half as long as eye. Lower pharyngeals rather narrow, each with a single row of sharp Eyes large; interorbital space a narrow, blunt, scaly ridge. Dorsal beginning over anterior margin of pupil, the rays all simple; candal fin with the middle rays slightly produced; anal preceded by a spine; pectoral half length of head. Scales of colored side small, firm, strongly ciliated, nearly uniform over head and body; lower jaw and snout scaleless; scales on blind side smooth. Head 3\frac{1}{3}; depth 2\frac{1}{3}. D. 94; A. 72; Lat. l. 96. L. 20 inches. Point Concepcion to Puget Sound; abundant; an important food-fish.

(Lockington, Scientific Press Supplement, April, 1879, i, 20; Lockington, Proc. U. S. Nat. Mus. 1879, 73.)

cc. Scales rather large, thin, and deciduous.

### 1275. H. exilis Jor. & Gilb.

Pale olivaceous brown, with dark points, forming edgings on each scale; bronze spots sometimes present; fins mostly dusky; dorsal and anal edged anteriorly with yellowish; ventrals largely yellow. Body slender, compressed, the flesh soft; moath not large, very oblique, the gape curved; lower jaw scarcely projecting, with a knob at symphysis; maxillary rather narrow, reaching middle of pupil, 23 in length of

head; teeth small, slender, close-set, nearly uniform; above in 2 series, below in 1. Eyes large, separated by a sharp, scaly ridge; lower eye advanced. Scales comparatively large, thin and deciduous, ctenoid, but not so rough as in the other species; those on blind side similar, less rough. Lateral line prominent. Fins low, fragile; anal preceded by a spine; caudal fin long, rather pointed; pectorals small, the right pectoral little more than half length of head. Gill-rakers short, slender, toothed, 9 below angle, the longest about one-third diameter of orbit. Head 4; depth 3\frac{1}{4}. D. 78; A. 62; V. 6; scales 16-71-18. L. 12 inches. A small, weak species, abundant in deep water, from San Francisco to Alaska.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 154.)

aa. Lateral line with an accessory dorsal branch; teeth in one row; dorsal beginning before eye. (Psettichthys\* Grd.)

### 1276. P. melanostictus (Grd.) J. & G.

Grayish brown, finely speckled with darker on body and fins. Body not very deep, elliptical; mouth rather small, the maxillary extending to below pupil,  $2\frac{3}{7}$  in head; teeth large, in a single series in each jaw, those in lower jaw largest; a few large canines in the front of each jaw. Eyes very small, separated by a broad, flat, scaly space, without ridge; lower eye slightly in advance of upper. Gill-rakers rather stout, weak, hooked at tip, 14 below the angle. Scales very small, etenoid on colored side. Lateral line nearly straight, with a long accessory dorsal branch. Dorsal commencing in advance of upper eye, the anterior rays elevated, slender and exserted, the longest about one-third length of head. First ray of dorsal nearly free from its membrane. Pectoral fin short,  $2\frac{1}{3}$  in head; anal fin preceded by a spine; candal large, strongly convex. Lower pharyngeals very narrow, each with one row of sharp recurved teeth. Head 4; depth  $2\frac{1}{3}$ . D. 85; A. 60; Lat. l. 112. Puget Sonud to Point Concepcion, common.

(Psettichthys melanostictus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 140: Psettichthys melanostictus Günther, iv, 420: Psettichthys melanostictus Lockington, Proc. U. S. Nat. Mus. 1879, 73.)

#### 456.-PLEURONICTHYS Girard.

(Heteroprosopon Bleeker.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 139: type *Pleuronichthys cœnosus* Girard.)

Eyes and color on the right side. Body deep; head short, with very

<sup>\*</sup> Girard, Proc. Acad. Nat. Sci. Phila. 1854, 140: type Psettichthys melanostictus Girard. (ψεττα, flounder; ίχθυς, fish.)

short, blunt snout; mouth small, with several series of slender, acute teeth, which are most developed on the blind side, and are often wanting in one or both jaws on the colored side; no teeth on vomer or palatines; lips thick, with several lengthwise folds, within which is a series of short fringes. Lower pharyngeals narrow, each with a double row of very small teeth. Gill-rakers wide-set, very short and weak. Lateral line nearly straight, with a dorsal branch in our species. Scales small, cycloid, non-imbricate, imbedded. Dorsal fin anteriorly twisted from the dorsal ridge toward the blind side; anal fin preceded by a spine; caudal fin convex behind. Intestinal canal elongate. Herbivorous species, feeding chiefly on algae. Pacific Ocean.  $(\pi\lambda\epsilon\nu\rho\nu\nu, \text{ side}; i\chi\theta\nu\varsigma, \text{ fish.})$ 

a. Dorsal fin beginning on the level of the lower lip; interocular ridge with blunt or sharpish tubercles.

#### 1277. P. decurrens J. & G.

Color brownish, usually much mottled with chocolate and grayish, often finely spotted with brownish on body and fins. Eyes very large,  $3\frac{1}{2}$  in head; a blunt tubercle in front of upper eye, another at each end of the narrow interorbital ridge, the posterior largest, but usually not spine-like; two or three above the latter behind the upper eye; some prominences above the opercle; a band of teeth on the right side of the lower jaw, similar to that on the blind side, but narrower. Vertical fins high, the longest dorsal and anal rays two-thirds the length of the head. Dorsal beginning very low, on level of end of maxillary, its first nine rays on the blind side. Head  $3\frac{3}{3}$ ; depth  $1\frac{4}{3}$ . D. 72; A. 46 L. 12 inches. Coast of California; rather common in deep water.

(Pleuronichthys comosus Lockington, Proc. U. S. Nat. Mus. 1879, 97. Pleuronichthys quadrituberculatus Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 50, nec Paflas; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 453.)

- aa. Dorsal fin beginning on the level of the upper lip.
  - b. Interocular ridge posteriorly with a strong, backward-directed spine.

### 1278. P. verticalis Jordan & Gilbert.

Color dark olive brown, mottled with lighter and darker, sometimes with light grayish spots; middle of sides often with a dark spot occllated with light olive, this again surrounded by darker; fins light, often tinged and margined with reddish, and mottled with blackish. Eyes large, 3½ in head; a tubercle in front of each eye, and one at anterior end of interorbital ridge; posterior end of ridge with a strong, sharp, backward directed spine; a tubercle behind upper eye; right side of lower jaw without teeth. Dorsal and anal fins lower than in P. decur-

rens, the longest rays  $1\frac{2}{3}$  length of the head; dorsal fin beginning opposite or slightly below the premaxillary, about five rays being on the blind side. Head 4; depth  $1\frac{7}{8}$ . D. 65-72; A. 45-48. Coast of California; not rare.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 49.)

bb. Interorbital ridge without distinct spine.

### 1279. P. cœnosus Girard.

Color light brown, blotched with chocolate color and yellowish, sometimes nearly plain, but usually profusely mottled; sometimes with ocellated blotches, sometimes with the light colors replaced by purplish red. Interorbital ridge prominent, but without spine or conspicuous tubercles, the tubercles of the other species being represented by slight elevations. Vertical fins very high, the longest rays of dorsal and anal two-thirds the length of the head. A narrow band of teeth on the colored side of the lower jaw. Dorsal fin beginning on the level of the premaxillary, its first five rays on the blind side; candal longer than head. Head  $4\frac{1}{4}$ ; depth  $1\frac{3}{4}$ . D. 68; A. 48–50. San Diego to Alaska, not generally common, but widely distributed; usually in deep water.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 139: Parophrys canosus Günther, iv, 456.)

### 457.-HVPSOPSETTA Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1864, 195: type Pleuronichthys guttulatus Grd.)

Eyes and color on the right side. Body broad, ovate, rhomboid; mouth very small; teeth slender, equal, acute, in several series; lips thick, not plicate. Lateral line nearly straight, with an accessory dorsal branch. Scales small, smooth. Dorsal fin beginning on the dorsal ridge, not turned to the blind side; anal spine present; caudal fin convex. Gill-rakers little developed. (δψί, deep; ψεττα, flounder.)

# 1280. II. gerttulata (Grd.) Gill. - Diamond Flounder; "Turbot."

Brown, with numerous pale-bluish blotches in life, these disappearing in spirits; blind side white, with a strong tinge of yellow along profile of head; fins plain, sometimes with black specks. Body very deep, somewhat angulated near middle of back and belly; eyes moderate, separated by a flattish, raised area; head without spines or tubercles; scales of opercular region little developed; those of blind side reduced; no teeth on right side of either jaw. Accessory lateral line long, half length of body. Anal spine small; pectorals about half length of head; ventrals rather short; caudal peduncle much deeper

than long; caudal large, nearly as long as head. Head  $3_4^8$ ; depth  $1_3^9$ . D. 68; A. 50; Lat. l. 95. L. 12 inches. A variable species. Coast of California; abundant.

(Pleuronichthys guttulatus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 137: Pleuronichtes guttulatus Günther, iv, 445: Parophrys ayresi Günther, iv, 456; Gill, Proc. Acad. Nat. Sci. Phila. 1864, 195: Pleuronichthys guttulatus Lockington, Proc. U. S. Nat. Mus. 1879, 94.)

# 458.-PLEURONECTES\* Linnaus.

#### Plaices.

(Platessa Cuvier: Platichthys and Parophrys Girard: Lepidopsetta, Myzopsetta, Liopsetta, and Euchalarodus Gill: Clidoderma and Pseudopleuronectes Bleeker: Limanda Gottsche: Flesus Moreau.)

(Artedi; Linnæus Systema Naturæ: type Pleuronectes platessa L.)

Eyes and color on the right side (except in *P. stellatus*, which is indifferently dextral or sinistral). Body ovate, elliptical, compressed; head moderate, sometimes tuberculate; mouth small, the small, narrow maxillary reaching front of eye or beyond; blind side with one (rarely two) series of close-set, conical or incisor-like teeth; colored side of both jaws usually toothless. Scales small, etenoid or cycloid, often imperfectly imbricated, sometimes tubercular or obsolete. Lateral line nearly straight, or more or less arched anteriorly, simple, or with an accessory branch. Gill-rakers small, widely set. Species very numerous in northern seas. (πλευρόν, side; νίχετης, swimmer.)

- a. Lateral line with an accessory dorsal branch, long or short.
  - b. Lateral line straight or with a slight arch.
    - e. Scales mostly cycloid, small, imbrigated. (Parophrus + Girard.)

#### 1281. P. vetulus (Grd.) J. & G.

Uniform light olive brown; the young somewhat spotted with blackish. Body elongate-elliptical; snout very prominent, much protruding, forming an abrupt angle with the descending profile; depth of head opposite middle of upper eye about equalling distance from middle of orbit to snout; eyes large, separated by a very narrow, high

<sup>\* &</sup>quot;If we were to attribute to some of the characters the same generic value as in other *Pleuronectida*, we should be obliged to establish a genus for almost every species, and to separate fishes which evidently form one natural group" (*Günther*, iv, 438). The curvature of the lateral line is here subject to much variation; the accessory lateral line, characteristic of so many Pacific species, disappears by degrees, while the gradations in dentition and squamation are so numerous as to be apparently useless for generic characters. We are unable to follow Dr. Günther in referring to *Pleuronectes*, the species of *Glyptocephalus* and *Cynicoglossus*, which seem to us to represent a well-differentiated type.

<sup>†</sup>Girard, Proc. Acad. Nat. Sci. Phila. 1854, 139: type Parophrys vetulus Girard.  $(\pi\alpha\rho\alpha$ , near together;  $o\varphi\rho\nu\varepsilon$ , eyebrow; in allusion to the narrow interocular space.)

ridge; eye large,  $4\frac{1}{2}$  in head, the upper with vertical range; mouth very small; maxillary not reaching pupil; teeth trenchant, small, and rather narrow, widened at tip; about 45 teeth on left side of lower jaw; few teeth on right side of lower jaw. Accessory lateral line long. Pectoral about half length of head; caudal truncate,  $1\frac{1}{2}$  in head. Fin rays entirely scaleless. Scales on body all cycloid, those on cheeks often slightly ciliated. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ . D. 74 to 86; A. 54 to 68; Lat. l. 105 (tubes). Santa Barbara to Alaska; an abundant species.

(Parophrys vetulus Girard, Proc. Acad. Nat. Sci. Phila. 1854, 140: Parophrys vetulus Günther, iv, 455: Pleuronectes digrammus Günther, iv, 445: Parophrys hubbardi Gill, Proc. Acad. Nat. Sci. Phila. 1862, 281.)

cc. Scales everywhere strongly ctenoid, well imbricated. (Isopsetta\* Lock.)
d. Scales closely imbricate; accessory lateral line long.

### 1282. P. isolepis (Lockington) J. & G.

Color brownish, mottled and blotched with darker. Body elliptical, much compressed, moderately deep, the curvature very regular; head moderate, strongly compressed, the profile little depressed above the eye; eyes rather large; interorbital space broad, flattish, with several series of scales. Scales on cheeks similar to those on body, rather large, ctenoid, and closely imbricated. Month comparatively large; maxillary reaching pupil,  $3\frac{2}{3}$  in head; teeth not large, about  $\frac{11+14}{9+24}$ , conical, close-set, in one somewhat irregular series, or partly in two series; those on colored side small. Lower pharyngeals each with a double row of bluntish teeth. On the blind side the scales are more or less ctenoid, sometimes smooth; those on the cheeks weakly ctenoid; most of the opercle, the preopercle, interopercle, and subopercle on blind side naked. Lateral line with a very slight arch in front, the depth of which is less than one-fifth the length; accessory branch nearly as long as head. Fins rather low, mostly covered with ctenoid scales. Head 4; depth 21. D. 88; A. 65; Lat. l. 88. L. 12 inches. Point Concepcion to Puget Sound; rather common in deep water. This species bears some resembrance to Hippoglossoides melanostictus.

(Lepidopsetta umbrosa Lockington, Proc. U. S. Nat. Mus. 1879, 106 (not of Girard): Lepidopsetta isolepis Lockington, Proc. U. S. Nat. Mus. 1880, 325.)

dd. Scales loosely imbricate; accessory lateral line very short.

### 1283. P. ischyrus J. & G.

Light olive brown, vaguely clouded with light and dark; fins reddish brown; a few roundish dusky blotches on dorsal and anal; pectoral and

<sup>\*</sup> Lockington MSS.: type Lepidopsetta isolepis Lock. (2605, equal; ψεττα, flounder.)

caudal tipped with dusky; blind side white, immaculate, or with small round rusty spots; left side of head sometimes rusty tinged. oblong, robust; eaudal peduncle rather long; snout projecting; forming an angle with the profile; mouth oblique, the chin projecting; teeth  $\frac{5+25}{10+29}$ , narrowly incisor-like, bluntish, in a single, rather close-set series; maxillary reaching past front of orbit, 52 in head; eyes large; interorbital space rather broad, scaly, continuous with a ridge above operele. Head mostly covered with scales like those of the body, but smaller and rougher. Gill-rakers feeble. Lower pharyngeals each with two rows of coarse blunt teeth. Seales thick and firm, adherent. not closely imbricated; those in front well apart; all the scales strongly ctenoid; blind side with similar scales, almost as strongly ctenoid. Vertical fins mostly scaly. Lateral line conspicuous, its scales less rough than the others; a distinct short accessory lateral line on both sides. extending to about the tenth dorsal ray, less than one-sixth head; a series of pores around lower eye behind. Dorsal beginning over pupil, its anterior rays low; its highest rays nearly half length of head; eaudal large, double truncate; pectoral of right side about half head. Head 34; depth 2. D. 70 to 76; A. 52 to 57; V. 6; Lat.l. 85. L. 15 inches. Puget Sound.

(Parophrys ischyrus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 276.)

bb. Lateral line with a strong arch in front; scales rough. (Lepidopsetta\* Gill.)

### 1284. P. bilineatus (Ayres) Gthr.

Yellowish brown, with numerous round pale blotches. Body broadly ovate, thickish; mouth moderate, turned toward the left side; teeth stout, conical, little compressed, bluntish, in one series, rather irregularly placed. Lower pharyngeals broad, with two rows of blunt teeth. Gill-rakers few, very short, thick and weak, without teeth. Snout projecting; eyes large, separated by a prominent ridge, which, like the cheeks and upper portion of the opercle, is covered with rough stellate scales; lower eye advanced; opercle, subopercle, and interopercle of left side scaly; preopercle naked. Scales rather small, mostly ctenoid, not closely imbricated; those on the blind side smooth; scales on the cheeks and other parts of the head very rough; scales of body smoother and less closely imbricated anteriorly, the degree of roughness variable, northern specimens (var. umbrosus) being roughest. Lateral line

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1864, 195: type *Platichthys umbrosus* Girard = *Platessa bilineata* Ayres. ( $\lambda \varepsilon \pi \imath \delta$  os, scaly;  $\psi \varepsilon \tau \tau \alpha$ , flounder.)

Bull. Nat. Mus. No. 16——53

moderately arched anteriorly, with an accessory dorsal branch, which is less than half length of head. Height of arch less than one-third its length. Dorsal beginning over the eye, its anterior rays low; caudal convex; anal preceded by a spine; a concealed spine behind ventrals; rays of dorsal and anal all simple; dorsal and anal somewhat scaly; caudal three-fifths length of head; pectoral half head. Lower pharyngeals broad, each with two rows of blunt teeth. Head  $3\frac{3}{5}$ ; depth  $2\frac{1}{8}$ . D. 80; A. 60; teeth  $\frac{27+7}{25+10}$ ; Lat. l. 85. L. 20 inches. San Francisco to Alaska; abundant northward. A food-fish of some importance.

(Platessa bilineata Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 40: Pleuronectes bilineatus Günther, iv, 444: Lepidopsetta bilineata Lockington, Proc. U. S. Nat. Mus. 1879, 103: Platichthys umbrosus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 136: Pleuronectes umbrosus Günther, iv, 454: Pleuronectes perarenatus Cope, Proc. Amer. Phil. Soc. 1873.)

aa. Lateral line without accessory branch.

e. Lateral line strongly arched in front; scales etenoid. (Limanda\* Gottsche.)

### 1285. P. ferrugimens (Storer) J. & G.-Sand Dab.

Brownish olive, with numerous, irregular, reddish spots; fins similarly marked; left side with caudal fin, caudal peduncle, and margins of dorsal and anal fins lemon vellow. Body ovate-elliptical, strongly compressed: teeth small, conical, close-set, in a single series on each Snout projecting, forming a strong angle above side in each iaw. upper eye, with the descending profile. Gill-rakers of moderate length, very weak, not toothed. Eyes moderate, 43 in head, the lower slightly in advance of upper, separated by a high, very narrow ridge, which is scaled posteriorly, and is continued backward as an inconspicuous but rough ridge to the beginning of the lateral line. Scales imbricate, nearly uniform, those on right side rough-ctenoid, those on left side nearly or quite smooth; scales on body rougher than on cheeks. Caudal peduncle short, higher than long. Dorsal inserted over middle of eye, its middle rays highest; pectoral less than two-fifths length of head; caudal fin rounded; anal spine present. Lateral line simple, with a rather low arch in front, the depth of which is barely two-fifths the length. A concealed spine behind ventrals; ventral of colored side partly lateral, the other wholly so; anal spine strong. Head 4 in length; depth  $2\frac{1}{5}$ . D. 85; A. 62; Lat. l. 100. Atlantic coast, chiefly northward.

(Platessa ferruginea Storer, Report Fish. Mass. 1839, 141: Platessa rostrata H. R. Storer, Bost. John. Nat. Hist. vi, 268: Myzopsetta ferruginea Gill, Proc. Acad. Nat. Sci. Phila. 1864, 217.)

<sup>\*</sup>Gottsche, Wiegmann's Archiv. 1835, 100: type Pleuronectes limanda L. = Limanda rulgaris Gottsche. (Limanda, an ancient name of L. rulgaris; perhaps from  $\lambda \bar{\iota} \mu \eta \nu$ , a small bay or creek.)

### 1286. P. asper Pallas.

Brown, nearly plain, the blind side with tinges of lemon-yellow. Form of *P. bilineatus*. Teeth small, almost conical, on both sides of the mouth; interorbital space narrow, scaly; operele and preoperele naked below. Gill-rakers very feeble. Pharyngeals not very broad, their teeth bluntish, not paved. Scales small, wide apart, partly imbedded, each one with 1–4 spinules, which are almost erect; anterior scales with 3–4 of these spinules; posterior mostly with 1; scales of blind side smoother; middle rays of dorsal and anal only scaly. No accessory lateral line. Anal spine present; twentieth anal ray and thirty-seventh dorsal ray longest; caudal double truncate. Head  $3\frac{1}{2}$ ; depth 2. D. 69; A. 53. Alaska to Kamtschatka.

(Pleuroucctes asper Pallas, Zoogr. Ross.-Asiat. iii, 425, 1811: Pleuroncetes asper Günther, iv, 454: Limanda aspera Bean, Proc. U. S. Nat. Mus. 1881, 242.)

### 1287. P. beani (Goode) J. &. G.

Grayish, mottled with darker; a conspicuous black blotch on the outer rays of caudal on each side. Body elliptical, with angular outlines, strongly compressed; head very short; snout abbreviated; mouth small, subvertical; teeth small, apparently in two rows, chiefly on the blind side of lower jaw; eyes large, as long as mandible; interorbital space very narrow. Dorsal fin beginning about pupil, its rays long, wide apart, exserted; right ventral near the median line. Caudal broad, fan-shaped. Lateral line with an abrupt curve, the length of which is twice its height and about equal to length of head, its scales highly specialized; lateral line on colored side less developed. Scales small, strongly etenoid on the right side; larger and cycloid on the blind side. Head  $5\frac{1}{2}$ ; depth  $2\frac{3}{5}$ . D. 64; A. 63; Lat. 1. 88, 27 scales in its curve. Deep water off the Rhode Island coast. (Goode.)

(Limanda beaui Goode, Proc. U. S. Nat. Mus. 1880, 473.)

- ee. Lateral line without anterior arch,
  - f. Eyes and color on either side; scales coarse, stellate; lower pharyngeals broad, with paved teeth. (Platichthys\* Grd.)

### 1288. P. stellatus Pallas.—California "Flounder."

Dark brown or nearly black, with lighter markings; fins reddish brown; dorsal and anal with four or five vertical black bands; caudal with three or four black longitudinal bands. Body broad and short, the snout forming a slight angle with the profile; lower jaw projecting; interocular space rather broad, with very rough scales. Large rough

<sup>\*</sup>Girard, Proc. Ac. Nat. Sci. Phila. 1856, 136: type Platichthys rugosus Grd.  $(\pi\lambda\alpha\tau\nu\varsigma,$  flat;  $i\chi\theta\dot{\nu}\varsigma$ , fish.)

scales at base of dorsal and anal rays and on sides of head; similar but smaller scales scattered over the body. Lateral line smooth. Fins without scales; a cluster of bony prominences above opercle. Teeth incisor-like, truncate, rather broad,  $\frac{10+15}{12+16}$ . Lower pharyngeals broad, with coarse, paved teeth. Head  $3\frac{2}{5}$ ; depth 2. D. 58; A. 42. L. 30 inches. San Luis Obispo to Kamschatka; very abundant northward; one of the largest and most important of the flounders of the Pacific coast.

(Pallas, Nov. Act. Petropol. 1, 347: *Platichthys rugosus* Girard, U. S. Pac. R. R. Surv. Fish. 148; Giinther, iv, 443: *Platichthys stellatus* Lockington, Proc. U. S. Nat. Mus. 1879, 91.)

- ff. Eyes and color strictly on the right side.
  - g. Scales not imbricated, usually ctenoid in the male, cycloid in the female; lower pharyngeals broad, with paved teeth. (Pleuronectes.)

### 1289. P. quadrituberculatus Pallas.

Grayish, mottled with paler and with round black spots; fins very dark. Form of P. glaber. Mouth very small, with small, incisor-like teeth, rounded at tip. Eyes separated by a narrow ridge; about five small, prominent, conical, obtuse bony tubercles in a row above the opercle, continuous with the direction of the lateral line, which is straight, without accessory dorsal branch; tubercle above opercle largest. Scales small, cycloid in all specimens examined. Anal spine present. Head  $3\frac{1}{3}$ ; depth 2. D. 68; A. 50; Lat. 1. 78. Coasts of Alaska and Kamtschatka.

(Pallas, Zoogr. Ross.-Asiat. iii, 423, 1811: Parophrys quadrituberculatus Günther, iv, 456; Bean, Proc. U. S. Nat. Mus. 1881, 241: Pleuronectes pallasi Steindachner, Ichth. Beiträge, viii, 45, 1879.)

### 1290. P. glaber (Storer) Gill.

Grayish brown, mottled with darker brown; fins with blackish spots. Body oblong, ovate. Eyes rather small, separated by a naked elevated ridge. Jaws sometimes each with two distinct rows of teeth; the interrapted outer series of truncate, close-set, thickish incisor-like teeth, which are sometimes movable; the inner row of similar teeth more widely set and rather distant from the outer row (and often or generally wanting); about 20 teeth in outer row in lower jaw; right side of both jaws toothless; interorbital ridge continuous with a broad, naked, smoothish, tuberculose ridge, which joins the lateral line. Scales small, distant, non-imbricate, smooth in the female and more or less ctenoid in the male; those on blind side smaller. Fins moderate, somewhat scaly; anterior rays of dorsal low; pectoral a little more than half head; bases of vertical fins not tuberculate. Anal spine present. Lower pharyngeals

separate, broad, with coarse teeth. Head  $3\frac{1}{2}$ ; depth 2. D. 55; A. 40; Lat. l. 70 (pores). L. 10 inches. Atlantic coast; chiefly northward.

(Platessa glabra Storer, Proc. Bost. Soc. Nat. Hist. i, 430, 1843, and Fish. Mass. 393, pl. 31, f. 1: Euchalarodus putnami Gill, Proc. Acad. Nat. Sci. Phila. 1864, 222—male; Bean, Proc. U. S. Nat. Mus. 1878, 347: Liopsetta glabra Gill, Proc. Acad. Nat. Sci. Phila. 1864, 217.)

#### 1291. P. glacialis Pallas.

Dark brown, the fins spotted. Form of *P. glaber*. A roughened ridge above the cheeks and opercles on the eyed side. Eyes separated by a narrow smooth bony ridge. Scales minute, imbedded, non-imbricate, etenoid in the males, smooth in the females; scales on blind side similar, less developed; scales of lateral line a little larger. Teeth colored, incisor-like, forming an even edge, mostly on blind side. An anal spine; pectorals short. Head 4; depth 2½. D. 56; A. 42. Alaska to Northern Siberia.

(Pallas, Itin. iii, App. 706; Pallas, Zoogr. Ross. Asiat. iii, 424: Pleuronectes glaciatis Richardson, Fauna. Bor.-Amer. Fish. 258; Bean, Proc. U. S. Nat. Mus. I881, 241: Pleuronectes cicatricosus Pallas, Zoogr. Ross.-Asiat. iii, 424 (♂, D. 59; A. 36): Pleuronectes tranklini Günther, iv, 442, 1862 (♀, D. 56; A. 37).

gg. Scales well imbricated, strongly etenoid; lower pharyngeals narrow, with conic teeth. (Pseudopleuronectes Bleeker.\*)

### 1292. P. americanus Walbaum.-Winter flounder; Mud dab.

Dark rusty brown, spotted or nearly plain; young olive brown, more or less spotted and blotched with reddish. Body elliptical, an angle above eye. Head covered above with imbricated, strongly ctenoid scales similar to those on the body; blind side of head nearly naked; interorbital space rather broad, strongly convex, its width half eye; the space entirely scaled; teeth compressed, incisor-like, and widened towards tips, close-set, forming a continuous cutting edge; some of teeth often emarginate, sometimes movable; right side of both jaws toothless. Highest dorsal rays less than length of pectorals, and more than half length of head; anal spine present. Head 4 in length; depth 24. D. 65; A. 48; Lat. I. 83. Coast of New York, northward; abundant.

(Walbaum, Artedi, Pisc. 1792, 113; Günther iv, 443; *Platessa plana* Storer, Fish. Mass. 373.)

## 459.—GLYPTOCEPHALUS Gottsche.

(Gottsche, Wiegmann's Archiv. 1835, 156: type Glyptocephalus saxicola Gottsche = Pleuronectes cynoglossus 1..)

Eyes and color on the right side. Body extremely elongate, more than twice as long as deep; much compressed. Head very small and

<sup>\*</sup> Bleeker, Comtes Rendus, Acad. Sci. Amst. xiii, 1862: type Platessa plana Storet. (ψεῦδος, false; πλευρονήχτης, Pleuronectes.)

short; its blind side with many excavations and mucous cavities in the skull, mandible, and preopercle. Mouth very small; teeth moderate, incisor-like, broad, equal, close-set, in a single series; no teeth on vomer or palatines. Gill-rakers short, weak. Lower pharyngeals narrow, with one or two rows of conical teeth. Lateral line nearly straight, simple; scales very small, smooth; dorsal and anal very long, there being more than 90 rays in the dorsal and more than 80 in the anal; candal fin rounded; anal spine present. Vertebræ in increased number. Northern seas.  $(\gamma \lambda o \pi \tau \delta \varepsilon$ , sculptured;  $z \varepsilon \varphi a \lambda \dot{\eta}$ , head.)

# 1293. G. cynoglossus (Linn.) Gill.—Craig-flounder.

Grayish brown; membranes of the fins with dark spots; pectoral of the colored side dark, about half as long as the head. Upper jaw with about 30 teeth; eyes large, separated by a narrow, scaly ridge; opercle adnate to shoulder-girdle for a short distance only. Pectorals very short, not falcate, that of right side about half length of head. Head 5 in length; depth 2\frac{3}{4}. D. 105 (101 to 112); A. 95 (87 to 99). Lat. l. 125. North Atlantic, on both sides; abundant in deep water northward.

(Pleuronectes cynoglossus Linn. Syst. Nat. i, 259, 1758: Glyptocephalns acadianus Gill, Proc. Acad. Nat. Sci. Phila. 1873, 361: Pleuronectes cynoglossus Günther, iv, 449: Pleuronectes elongatus Günther, iv, 450: Collett, Norske Nord-Havs. Exp. 260.)

#### 1294. G. zachirus Lockington.

Uniform brownish, fins darker; blind side everywhere dusted with dark points. Body elongate; snout very blunt; interorbital space a very narrow, scaly ridge; mouth somewhat twisted toward the blind side; teeth on both sides of jaws, broad and compressed, in a single row, forming a blunt, continuous edge; about 34 in the lower jaw. Eyes very large,  $3\frac{2}{5}$  in head. Opercle nearly free from shoulder-girdle. Pectoral of the colored side falcate, longer than the head, more than twice as long as the pectoral of the blind side. Body not slimy. Head  $4\frac{3}{5}$ ; depth 3. D. 94 to 106; A. 79 to 89; Lat. l. 138. L. 15 inches. Coast of California; in deep water.

(Lockington, Proc. U. S. Nat. Mus. 1879, 88.)

#### 460.—CYNICOGLOSSUS Bouaparte.

(Microstomus Gottsche, preoccupied by Microstoma: Brachyprosopon Bleeker.)

(Bonaparte, Fauna Italica, 1837, fase. xix: type Pleuronectes microstomus Don.)

This genus agrees with Glyptocephalus in the elongate body, long fins, and numerous vertebrae, differing in the absence of the cavernous

structure of the head. Anal spine obsolete. (χυνιχος, dog like; γλῶσσα, tongue.)

### 1295. G. pacificus Lockington.

Olive brown, with darker blotches; fins blackish; blind side more or less dusky. Body elongate, elliptical; snout not blunt; interorbital space a narrow, scaly ridge; eyes large, 3 in head; mouth very small; teeth large and very broad, forming a continuous cutting edge on blind side only of each jaw; about 10 teeth in lower jaw. Opercle above its angle wholly adnate to shoulder-girdle. Dorsal and anal fins low. Pectoral fins moderate, that of the colored side a little the longer, about two-thirds length of head; ventrals very small. Body excessively slimy in life. Head 4½; depth 3½. D. 102; A. 85; Lat. l. 140. L. 12 inches. Alaska to Monterey; abundant in deep water.

(Glyptocephalus pacificus Lockington, Scientific Press Suppl. i, 21, April, 1879: Glyptocephalus pacificus Lockington, Proc. U. S. Nat. Mus. 1879.)

### 461.—ETROPUS Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 364: type Etropus erossotus J. & G.)

Eyes and color on the left side. Body regularly oval, deep and compressed. Head small; mouth very small, the teeth close-set, slender and pointed, somewhat incurved, mostly on the blind side; no teeth on vomer. Eyes small, separated by a narrow, scaleless ridge; margin of preopercle free. Ventrals free from anal, that of colored side inserted on ridge of abdomen, its base rather long. Dorsal fin beginning above eye; caudal double truncate; anal without spine. Scales thin, decidnous, etenoid on left side, cycloid on blind side. Lateral line simple, nearly straight. Size small. This genus is apparently allied to Citharichthys, although the month is very small. (ετρου, abdomen; ποῦς, foot; in allusion to the insertion of the ventrals.)

### 1296. E. crossotus J. & G.

Light brown, with some darker blotches; fins mottled and spotted. Teeth in lower jaw on both sides, in upper on blind side only. Eyes large, separated by a narrow scaleless ridge, which extends above the opercle; edge of preopercle and especially of opercle on blind side fringed with white cilia. Candal one-fourth longer than head; pectoral of left side three-fifths head; ventral of blind side longest, inserted in advance of the other. Head 4½; depth 2. D. 80; A. 61; V. 6; Lat. l. 68. L. 5 inches. Coast of Louisiana and Texas to Mazatlan and Panama; locally abundant.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 364; 1882, —.)

#### 462 .- THVRIS Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, 344: type Thyris pellucidus Goode.)

Body elongate, soft, and translucent. Head very short; mouth small, toothless. Eyes sinistral, close together, the lower slightly advanced. Pectorals of blind side smallest; ventrals crowded together on median keel of body, their bases prolonged on this keel. Rays simple; dorsal beginning on the snout; caudal subsessile, almost confluent with dorsal and anal. Scales very thin, easily detached, probably cycloid. Lateral line well marked, straight. One species known, from deep water.  $(\theta \delta \rho \ell \xi,$  window, from the translucent body.)

### 1297. T. pellucidus Goode.

Colorless, translucent; three conspicuous dusky longitudinal lines on left side, the middle one faintest. Two streaks on right side; eyes black.' Body thin, pellucid, divided into three longitudinal tracts by depressions at the bases of the rows of interspinous processes. Scales small, thin, caducous. Head very small; eyes small, protruding, their diameter equal to the interorbital space and half the length of the snout; mouth small, formed as in the soles, the upper jaw somewhat hook-shaped. Dorsal fin beginning in advance of the eye, of long, flexible, simple, rays, the tips of which are much exserted. Pectorals inserted far below lateral line, that on blind side as long as orbit, the other as long as snout; ventrals reaching past front of anal. Head 5; depth 3. D. 100; A. 80; P. 12 (left), 4 (right). L. 3 inches. (Goode.) Gulf Stream, off the coast of Rhode Island. Perhaps a larva of some species of which the mature form is as yet unknown.

(Goode, Proc. U. S. Nat. Mus. 1880, 344.)

#### 463.-MONOLENE Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, 338: type Monolene sessilicauda Goode.)

Body thin, clongate; eyes on the left side, very close together, near the profile; mouth moderate, the length of the maxillary less than one-third that of the head; teeth minute, in a single series, nearly equal on both sides; no teeth on vomer or palatines. Scales rather large, etenoid on colored side, cycloid on blind side. Lateral line well-marked, that of colored side strongly and angularly curved anteriorly; that of blind side nearly straight. Pectoral of blind side wholly absent; dorsal beginning on the snout, its rays all simple. Caudal fin sessile, almost confluent with dorsal and anal. Ventral fins normal. Gill-rakers few, feeble. Vertebræ 43. Deep-sea fishes. (μόνος, single; ἀλένη, arm.)

### 1298. M. sessilicanda Goode.

Ashy brown, with darker brown spots; blind side white; pectoral blackish, with traces of darker transverse bands. Body thin, its thickness not greater than the diameter of the eye; depth 7½ times the diameter of the eye; head everywhere closely thatched with scales even to the edges of the lips. Vertical fins mostly scaly. Lateral line on left side arched, its direction peculiar, the curve having two angles; lateral line on blind side nearly straight. Dorsal beginning on the snout, highest posteriorly, its longest rays half the head; anal beginning close to the vent. Caudal rounded. Pectoral three-fourths length of head. Ventrals on the median line, equal. Head 5; depth  $2\frac{2}{3}$ . D. 99 to 103; A. 79 to 84; scales 23–92–25, 20 in the anterior curve. L. 6 inches. Gulf Stream, off Newport, Rhode Island. (Goode.)

(Goode, Proc. U. S. Nat. Mus. 1880, 338.)

### 461.—ACHIRUS Lacépède.

Soles.

(Lacépède, Hist. Nat. des Poiss. iv, 659, 1802: type Pleuronectes achirus L. = Achirus fasciatus Lac. = Pleuronectes lineatus L.)

Eyes and color on the right side. Body oblong, bluntly rounded anteriorly. Head small; eyes small, close together, the upper eye in advance of the lower; mouth small, somewhat turned toward the colored side; nasal flaps present, the nostril of the blind side fringed; lip of the colored side fringed; teeth very small, on blind side only; gill-openings narrow; the branchiostegal region scaled. Head closely scaled everywhere, the scales on the colored side similar to those on the body, those of the nape and chin much enlarged; scales on the blind side anteriorly, have their pectinations more or less produced, forming cirri; scales of both sides extremely rough, extending on the fins. Lateral line straight, simple; edge of preopercle covered by the scales. Dorsal beginning on the snout, low in front and thickly scaled, its rays divided; anal fin similar, without spine; caudal fin free, convex; caudal peduncle very short and deep; pectoral fin of left side wanting, that of right side small or obsolete; ventral rays 3 or 4, the ventral fin of the colored side long, connected with the anal by a membrane. (azeig, without hands; i. e., without pectoral fins.)

a. Pectoral fins both obsolete. (Achirus.)

### 1299. A. lineatus (L.) Cuv.

Olive brown, usually with about 6 narrow vertical black cross-lines usually not broader than pupil and with numerous black spots and

clouds; fins with dark spots, some of which form bars parallel with the rays; left side white, usually more or less mottled, sometimes barred. Form oval, the outlines regular. Eyes small, separated by a flattish space wider than eye. A concealed spine in front of upper eye. Scales on nape and chin 3 or 4 times size of others. Fins moderate, scaly on both sides; caudal about as long as head. Head 3½; depth 1½. D. 55; A. 41; V. 4; Lat. l. 75. L. 6 inches. Atlantic coast, common from Cape Ced southward; ascending rivers.

(Pleuronectes achirus L. Syst. Nat. ed. 10, i, 268: Pleuronectes lineatus L. Syst. Nat. ed. 12, i, 458: Achirus mollis Storer, Fish. Mass. 400: Solea achirus Günther, iv, 476.)

Subsp. browni (Gthr.) J. & G.

Cross-bands broader, as broad as eye; left side immaculate. Gulf of Mexico and southward.

(Solca browni Günther, iv, 477.)

### 465.-APHORISTIA Kaup.

(Kaup, Wiegmann's Archiv. 1858, 106: type Archirus ornatus Lacépède.)

Eyes and color on the left side. Body clongate, lanceolate in outline, rounded forward, tapering to a point behind, strongly compressed. Month small, unsymmetrical, twisted toward the colored side; teeth small; eyes very small, close together; snout short, not produced, with a hook; lips conspicuous, not evidently fringed; one nostril present, with a slight barbel, just before lower eye. Scales etenoid, of moderate size, covering the whole body nearly uniformly; edge of preopercle covered by the scales; no lateral line on either side. Dorsal fin low, beginning just behind the snout, confluent with the anal around the tail; pectoral fins obsolete; ventral fin of colored side only present, not continuous with the anal. Gill-openings very narrow. Warm seas. (ἀφορία, a dearth; ἱστος, a limb.)

### 1300. A. atricauda Jor. & Gilb.

Olivaceous, with very distinct dark streaks along the rows of scales, and with numerous vertical half-bars; those above lateral line alternating with those below, anteriorly, nearly meeting them behind; vertical fins black posteriorly. Body oblong-lanceolate, comparatively slender, not very blunt anteriorly. Month reaching to opposite the eye; lips large; teeth small, present on both sides. Scales small, much smaller on the head; those on blind side similar. Dorsal beginning on the head; ventral well separated from anal. Head 5\frac{1}{3}; depth 3\frac{1}{3}. D. 100; A. 80; Lat. l. 105. L. 5 inches. San Diego, Cal.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 23.)

## 1301. A. plagiusa (L.) J. & G.

Dark brown, with six or seven obscure darker cross-bands, and numerous dark specks and mottlings, forming indistinct stripes; fins all speckled, the caudal not darker than the other fins. Teeth very small, present on both sides of the jaw; eyes very small, close together, the upper in advance, the lower just above angle of month. Ventral fin moderately developed, barely reaching anal, to which it is connected by a low membrane. Head 5; depth 3\frac{1}{4}. D. 95; A. 80; Lat. l. 93. South Atlantic and Gulf coast to the West Indies; abundant in sandy bays.

(Pleuronectes plagiusa Linn. Syst. Nat.: Plagusia plagiusa Gill, Cat. Fish. E. coast, 794: Achirus ornatus Lac. iv, 659: Aphoristia ornata Gthr. iv, 490.)

# ORDER V.—PEDICULATI.

(The Pediculate Fishes.)

Carpal bones notably elongate, forming a sort of arm, which supports the broad pectorals. Gill-openings reduced to a large or small foramen, situated in or near the axils, more or less posterior to the pectorals. No scales. Ventral fins jugular, if present; first vertebrae united to the cranium by a suture; epiotics united behind supraoccipital; elongate basal pectoral radii reduced in number; no interclavicles; posttemporal broad, flat, simple; superior pharyngeals two, similar, spatulate, with anterior stem and transverse blade; basis of cranium simple. No air-duct to the swim-bladder. Anterior dorsal reduced to a few tentacle-like, mostly isolated, spines. This group is considered as a modified offshoot from Batrachoid or Blennioid forms. (Latin pediculatus, provided with a little foot or peduncle, in allusion to the peculiar pectoral fins.)

(Pediculati Giinther, iii, 178-205.)

### ANALYSIS OF FAMILIES OF PEDICULATI.

- - bb. Pseudobranchiæ none; pseudobrachia with three actinosts.
- aa. Gill-openings in or behind the upper axils; month small, usually inferior.

Maltheide, 126.

## FAMILY CXXIV.—LOPHIIDÆ.

(The Fishing Frogs.)

Head wide, depressed, very large. Body contracted, conical, tapering rapidly backward from the shoulders. Mouth exceedingly large, terminal, opening into an enormous stomach; upper jaw protractile; maxillary without supplementary bone; lower jaw projecting; both jaws with very strong, unequal, cardiform teeth, some of the teeth canine-like, most of them depressible; vomer and palatines usually with strong teeth. Gill-openings comparatively large, in the lower axil of the pectorals. Pseudobranchiæ present. Gill-rakers none. Skin mostly smooth, naked, with many dermal flaps about the head. Spinous dorsal of three isolated, tentacle-like spines on the head, and three smaller ones behind, which form a continuous fin; second dorsal moderate, similar to the anal; pectoral members scarcely geniculated, each with two actinosts and with clongate pseudobrachia; ventrals jugular, I, 5, widely separated. Pyloric cœca present. A single genus, with three or more species, living on sea-bottoms; remarkable for their great voracity.

(Pediculati part, genus Lophius Günther, iii, 178-182.)

## 466.-LOPHIUS Linnaus.

## Fishing Frogs.

(Artedi; Linnaus, Syst. Nat. 1758: type Lophius piscatorius L.)

Characters of the genus included above. (Lophius, the ancient name of L. piscatorius, from  $\lambda \acute{\sigma} \varphi \circ \xi$ , a crest.)

1302. L. piscatorius.—Fishing-frog; Mouk-fish; Goose-fish; All-mouth; Bellows-fish; Angler.

Brownish, mottled, below white; mouth behind the hyoid bone immaculate; pectorals and caudal black at tip; peritoneum black. Body depressed, tapering, scarcely longer than head. Humeral spine with three points, of which the posterior is the longest. Head surrounded with a fringe of barbels; top of head, in young, with many strong spines. Anterior dorsal spine elongate, fleshy at tip. D. I–I–I, III—10; A. 9. L. 3 feet. North Atlantic, on both coasts; generally common, from North Carolina northward. A fish of singular uglmess of appearance.

(Linn. Syst. Nat.; Günther, iii, 179: Lophius americanus Cnv. & Val. xii, 380.)

# FAMILY CXXV (a).—ANTENNARIID.E.

(The Frog-fishes.)

Head and body more or less compressed. Month vertical or very oblique; lower jaw projecting; jaws with cardiform teeth; premaxillaries protractile. Gill-openings small, pore-like, in or behind the lower axils of the pectorals. No pseudobranchiae. Skin naked, smooth, or prickly. Pectoral members forming an elbow-like angle. Pseudobrachia long, with three actinosts. Ventral fins present, jugular, near together. Spinous dorsal of one to three separated, tentacle-like spines; soft dorsal long, larger than anal. Pyloric ceca none. Genera about 5; species nearly 40. Inhabitants of tropical seas, "living on floating seaweed, and enabled, by filling the capacious stomach with air, to sustain themselves on the surface of the water"; therefore, widely dispersed by currents in the sea.

(Pediculati pt. Günther, iii, 182-200.)

- a. Head compressed: a rostral spine or tentacle, followed by two larger spines; palatine teeth developed.

## 467.—ANTENNARIUS Lacépède.

(Chironectes Cuv.)

(Commerson; Lacépède, Hist. Nat. Poiss, i, 421, 1798: type Antennarius chiroucctes Commerson.)

Body oblong, compressed, very deep through the occipital region, tapering behind: breast tumid. Mouth rather large, more or less oblique, or even vertical; cardiform teeth on jaws, vomer, and palatines. Eye small. Skin smooth, granular or spinous, with numerous fleshy slips. First dorsal spine developed as a small rostral tentacle; second and third dorsal spines strong, covered with skin, with numerous fleshy filaments; soft dorsal high and long; anal short and deep; caudal fin rounded; pectoral fins moderate, with a more or less slender wrist, at the lower posterior angle of which are the very small gill-openings; ventral fins well developed. Fantastic-looking fishes; very numerous in warm seas. (Latin antenna, a feeler or tentacle.)

 $a.\ \ Ventral\ fins\ long;\ skin\ smooth\ or\ nearly\ so;\ month\ oblique.\quad (\textit{Pterophrynoides*}\ Gill.)$ 

1303. A. histrio (L.) J. & G.-Mouse-fish; Toud-fish.

Yellowish, marbled with brown; 3 dark bands radiating from eye;

Pterophryne Gill, Proc. Acad. Nat. Sci. Phila. 1863, 90: type Chirocetes bongainvillei
C. & V.; preoccupied as Pterophrynus: Pterophrynoides Gill, Proc. U. S. Nat. Mus. 1878. 216. (πτερον, wing; φρυνη, toad; ειδος, resemblance.) This genus is per-

haps worthy of retention.

vertical fins barred with brown; belly and sides with small white spots. Skin of head and body, as well as dorsal fins, with fleshy tags, which are most numerous on the dorsal spines and abdomen. Wrist slender; ventrals large, nearly half as long as head. Dorsal and anal with the posterior rays not adnate to caudal peduncle. Head  $2\frac{1}{5}$ ; depth  $1\frac{1}{5}$ . D. III-14; A. 7; V. 5. Tropical parts of the Atlantic; abundant on our Gulf coast and occasional northward.

(Lophius histrio Liun. Syst. Nat. ed. 10, 237: Chironectes larigatus Cuv. Mem. Mus. iii, 123: Antennarius marmoratus Günther, iii, 185: Pterophryne histrio Gill, Proc. U. S. Nat. Mus. i, 216, 1878.)

aa. Ventral fins short; skin spinous; mouth vertical. (Antennarius.)

#### 1304. A. amenulatus Gill.

Fawn-color, lighter below; many black spots ocellated with white both on the body and fins; body with several pink areas, one of which forms a triangular saddle in front of the dorsal and another a broad ring around the base of the caudal fin; angles of mouth with a pink spot. Mouth large, vertical. First dorsal spine slender and straight, terminating in three simple tentacles; third dorsal spine partly imbedded in the skin; wrists and pectorals widened; ventrals short. Skin covered with bifid spines. (Gill.) Garden Key, Florida.

(Gill, Proc. Acad. Nat. Sci. Phila, 1863, 92.)

## 1305. A. pleurophthalmus Gill.

Brown, marbled with lighter, and with scattered black dots; each side with three large black spots occillated with brownish; one on dorsal near its base, a second immediately below it on the sides, and a third in the middle of the candal fin; mouth behind tongue black, with yellow lines. Skin covered with minute bifurcated spines. First dorsal spine terminating in a fringed lobe; second spine longer than the first, its membrane extending nearly to the base of the third spine, the latter nearly free. (Gill.) Key West, Florida.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 92.)

## 468.-CMAUNAX Lowe.

(Lowe, Trans. Zoöl. Soc. Lond. iii, 339, 1846: type Chaunax pictus Lowe.)

Head very large, depressed, cuboid. Mouth large, subvertical; jaws and palate with eardiform teeth. Skin with minute spines. Spinous dorsal reduced to a small tentacle above the snout; soft dorsal moderate, low; anal short. Muciferous channels conspicuous. Atlantic. (γαόναξ, one who gapes.)

## 1306. C. pictus Lowe.

Bright orange above; sides rosy; fins vermilion. Rostral tentacle short, pedicellate; muciferous channels, appearing as chain-like rows of pits. Head 1\frac{1}{3}: depth 5\frac{1}{2}. D. I-11; A. 5; P. 11; V. 4; C. 7. Deep sea; taken at Madeira and off the coast of Rhode Island.

(Lowe, Trans. Zoöl. Soc. Lond. iii, 339, 1°46; Günther, iii, 200; Goode, Proc. U. S. Nat. Mns. 1880, 470.)

# FAMILY CXXV (b).—CERATHD.E.

Head and body compressed. Mouth terminal, more or less oblique. Gill-openings small, in the lower part of the axils. No pseudobranchiae. Spinous dorsal represented by one or more tentacles. Pectoral members not geniculated, with short pseudobrachia and three actinosts. No ventral fins. Fishes of the open seas, usually inhabiting considerable depths; about 6 genera and 7 or 8 species known. All are uniform blackish in color.

(Pediculati, genus Ceratias, Günther, iii, 205: Ceratiidæ Gill, Proc. U. S. Nat. Mns. 1878, 216.)

- a. Month moderate.
  - b. Gill-arches unarmed; gills 2½ pairs.
    - c. Cleft of mouth nearly vertical; skin prickly.
      - d. Second dorsal spine developed
         CERATIAS, 469.

         dd. Second dorsal spine obsolete
         MANCALIAS, 470.
    - cc. Cleft of mouth nearly horizontal; skin smooth; second dorsal spine developed.
  - bb. Gill-arches armed with dentigerous tubercles; gills in ½ 2½ pairs; skin with scattered tubercles; second dorsal spine obsolete......Инмахтологися, 472.

## 469.—CERATIAS Kröyer.

(Kröyer, Naturhist, Tidsskrift, 2 række, i, 639, 1844: type Ceratias holbölli Kröyer.)

Head and body much compressed and elevated, covered with prickly skin. Month wide, its eleft nearly vertical; teeth in jaws conic, movable, of moderate size; no teeth on vomer or palatines. Gills 2½; gill-arches unarmed. Spinous dorsal reduced to two spines, one on the head, the other on the back, the basal element of the second spine exserted; soft dorsal and anal short; pectorals very short, broad, of about 20 rays. Pyloric coca 2, small. Skeleton soft, fibrons. Greenland. (zspaziaz, one that has horns.)

## 1307. C. holbölli Kröyer.

Black. Caudal fin very long, lanceolate, longer than the trunk (exclusive of head). Cephalic spine reaching, when depressed, beyond

base of caudal; membrane behind dorsal and anal extending nearly to base of caudal. D. I, I, 4; A. 4; C. 8; P. 19. Greenland.

(Kröyer, Naturh, Tidsskr. 1844, 639; Günther, iii, 205.)

## 470.-MANCALIAS Gill.

(Gill, Proc. U. S. Nat. Mus. i, 227, 1878: type Ceratias uranoscopus Murray.

General characters of *Ceratias*, but with the spinous dorsal reduced to a rostral spine, and two fleshy claviform tubercles behind it. Pectoral fins narrow, with about 10 slender rays. (Latin *maneus*, defective, "with a quasi-diminutive termination to correspond with *Ceratias*.")

## 1308. M. uranoscopus (Murray) Gill.

Uniform black. Anterior spine of first dorsal produced in a long filament, ending in a pear-shaped bulb, terminating in a semi-transparent whitish spot, this spine originating on posterior part of head, and reaching, when depressed, nearly to the tip of tail; far behind this are two short, fleshy tubercles, lying in a depression in front of second dorsal. Teeth moderate, depressible. Skin everywhere with minute, imbedded conical spines. Eyes very small, placed high on the middle of the head. D. I-3 or 4; A. 4; C. 8; P. 10. (Murray.) Deep seas; taken at Madeira and off the coast of Southern New England.

(Ceratias uranoscopus Murray, in Wyville Thompson, The Atlantic, ii, 67, 1878; Gill, l. c. 228; Goode, Proc. U. S. Nat. Mus. 1880, 469.)

#### 471.-ONIRODES Liitken.

(Oneirodes Liitken, Overs. Kong. Dansk. Vidensk. Selsk. Forhandl. 1871, 56: type Oneirodes eschrichtii Liitken.)

Head and body compressed, oval, covered with smooth skin. Month moderate, almost horizontal; vomer with teeth. Gill-arches unarmed; gills in  $2\frac{1}{2}$  pairs. Spinous dorsal represented by a rostral spine, the basal element of which is procumbent and subcutaneous, and a second spine about midway between the rostral spine and the soft dorsal. Greenland. ( $\partial z = i \mu \phi \partial \eta_{\xi}$ , dream-like, in allusion to the small, almost covered, eyes.)

## 1309. O. eschrichti Lütken.

Black; terminal half of the bulb of the cephalic spine whitish. Cephalic spine with a bulbous termination, surmounted by slender filaments, in several transverse rows. Caudal fin shorter than trunk, without head. D. II-4. Deep sea, off Greenland. (Gill.)

(Lütken, Dansk. Vidensk. Selsk. Forh. 1871, 57; Gill, Proc. U. S. Nat. Mus. 1878, 218.)

erate size; chin with a barbel; jaws with bands of villiform teeth; vomer and palatines toothless. Dorsals 2; anal fin single, not notched; ventral fins with 5 rays, the outer rays filamentons; caudal rounded, slender, free; branchiostegals 7. (A diminutive of *Phycis.*)

## 1234. P. dalwigkii Kaup.

Color uniform brownish; pectoral and anal whitish; axil of pectoral, chin, and belly blackish; inside of mouth white. Head broad, depressed; cleft of mouth oblique; maxillary extending beyond vertical from pupil; interorbital space flat, its width rather less than vertical diameter of orbit; a concealed spine on each side of nape. Height of first dorsal equalling half length of head; second dorsal somewhat lower, nearly uniform in height; anal similar to second dorsal, but lower; pectorals two-thirds length of head; filamentous ventral ray not reaching anal. Eleven series of scales between anterior dorsal and lateral line. Head 4 in length; depth 5½. D. 7-67; A. 69; V. 5. (Günther.) Madeira; lately taken in deep water off the coast of Massachusetts.

(Kaup, Wiegin. Arch. 1858, 88; Günther, iv, 348.)

#### 440.-MOLVA Nilsson.

## Lings.

(Nilsson, Skandinav. Fauna, 1832, iv, 573: type Gadus molra L.)

Body clongate, covered with very small scales. Chin with a barbel; lower jaw included; bands of teeth on jaws and vomer; lower jaw with large canines which are arrow-shaped and movable; vomer with a curved series of canines, mixed with small teeth, these mostly fixed; no teeth on palatines. Gill-membranes broadly united. Two dorsal fins, both well developed; one anal fin; ventrals of several rays. Northern seas. (An old name of *M. vulgaris.*)

## 1235. M. vulgaris Fleming.—Ling.

Barbel longer than eye; a short barbel at the nostril; eye as wide as interorbital space. D. 15-66; A. 62; V. 6; vertebræ 27 + 37. (Günther.) Greenland and Northern Europe.

(Gadus molva L. Syst. Nat.; Fleming, Brit. Anim. 192; Günther, iv, 361.)

### 441.-LOTA Cuvier.

#### Burbots.

(Cuvier, Règne Anim. ii, 1817: type Gadus lota L. = Lota vulgaris Jenyns.)

Body long and low, compressed behind. Head small, depressed, Bull. Nat. Mus. No. 16——51

rather broad; anterior nostrils each with a small barbel; chin with a long barbel; snout and lower parts of head naked; mouth moderate, the lower jaw included; both jaws with broad bands of equal, villiform teeth, vomer with a broad, crescent-shaped band of similar teeth; no teeth on palatines. Gill-openings wide, the membrane somewhat connected, free from the isthmus. Scales very small, imbedded; vertical fins scaly. Dorsal fins two, the first short, the second long, similar to the anal; caudal rounded, its outer rays procurrent; ventrals of several rays. One species, living in fresh waters of northern regions. (Lota, the ancient name.)

## 1236. L. maculosa (Le S.) C. & V.—Burbot; Lake Lawyer; Ling.

Dark olive, thickly marbled and reticulated with blackish; yellowish or dusky beneath; young often sharply marked, the adult becoming dull-grayish; vertical fins with dusky margins. Maxillary reaching to posterior margin of eye; barbel longer than the very small eye; pectoral  $1\frac{3}{5}$  in head; ventrals reaching half way to vent. Head  $4\frac{3}{3}$ ; depth 6. D. 13-76; A. 68; V. 7; vertebræ 21+38; cæca 30. L. 2 feet. New England and Great Lake region, north to the Arctic seas; abundant northward; also (var. *vulgaris*) throughout Northern Europe and Asia.

(Gadus lota L. Syst. Nat.: Gadus maculosus Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 83, 1873: Lota compressa, inornata, and maculosa Dekay, New York Fauna, Fish. 1842, 283–285: Lota vulgaris Jenyns, Manual Brit. Vert. 448: Lota vulgaris Günther, iv, 359.)

#### 442.-BROSMIUS Cuvier.

#### Cusks.

(Cuvier, Règne Anim. ii, 1817: type Gadus brosme Müller.)

Body moderately elongate, covered with very small scales. Mouth rather large, with teeth in the jaws, vomer, and palatines, some of those on the vomer and palatines enlarged; chin with a barbel; branchiostegals 7. Dorsal fin single, continuous, not elevated; anal fin similar, but shorter; caudal fin rounded; ventral fins several-rayed. Fishes of the Northern seas. (A latinization of the vernacular name brosme.)

## 1237. B. brosme (Müller) White.—Cusk.

Brownish, mottled; young uniform dark slate-color, or with transverse yellow bands; vertical fins bordered with blackish, and with a white edge. Head flattened above; upper jaw slightly longer than lower; mouth large, oblique; maxillary reaching beyond orbit. Head

4<sup>1</sup>; depth 5<sup>1</sup>. D. 98; A. 71. (Storer.) Polar regions, south to Cape Cod and Denmark.

(Gadus brosme Müller, Prodr. Zoöl, Dan. 41, 1776; Gadus brosme Fabr. Faun. Greenl. 140; Brosmius flavescens Günther, iv, 369; Brosmius flavescens Storer, Fish. Mass. 368; Brosmius brosme Günther, iv, 369; Brosmius vulgaris Dekay, New York Fauna, Fish. 289.)

### 443.-GADUS Linnaus.

## Cod-fishes.

(Artedi; Linnæns, Syst. Nat.: type Gadus callarias or morrhua L.)

Body moderately elongate, compressed and tapering behind. Scales very small; lateral line present. Head narrowed anteriorly; mouth moderate or large; chin with a barbel, which is sometimes minute; teeth cardiform, subequal, or with those of one series more or less enlarged; vomer with teeth; none on the palatines. Dorsal fins three, well separated; anal fins two; ventral fins well developed, of about seven rays. Species of the Northern Seas; highly valued as food.

(Gadus, the Latin name, akin to the English word Cod.)

- a. Lower jaw included; barbel well developed.
  - b. Vent below second dorsal; species of large size.
    - Lateral line black; mouth small, the maxillary not reaching eye. (Melanogrammus\* Gill.)

## 1238. G. reglifinus L.-Haddock.

Dark gray above, whitish below; lateral line black; a large dark blotch above the pectorals; dorsals and caudal dusky. Snout long and narrow, overlapping the small mouth; maxillary barely reaching front of orbit; teeth subequal, large, in a cardiform band in upper jaw; in a single series on lower jaw and on vomer; occiput earinated; a ridge extending backward from each orbit; eye very large, two-thirds length of snout, 4 in head. Anterior rays of first dorsal elevated, three fourths length of head, the fin pointed, higher than second and third dorsals; caudal lunate; vent below front of second dorsal. The skull in this species is more depressed than in *Gadus callarias*, broader, and thinner in texture; occipital crest exceedingly high, much higher than in *Gadus*, the wing-like projections at its base anteriorly spreading widely, raised above the surface of the skull. Head 3\frac{3}{4}; depth 4\frac{1}{2}.

D. 15-24-21; A. 23-21. North Atlantic, on both coasts; an important food-fish, reaching a considerable size.

(Gadus æglifinus Linnæns, Syst. Nat.: Gadus æglifinus Günther, iv, 332: Melanogrammus æglifinus Gill, Proc. Acad. Nat. Sci. Phila. 1863, 237.)

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1863, 237: type Gadus wglifinus L.  $(\mu \epsilon \lambda \alpha \epsilon, \text{ black}; \gamma \rho \alpha \mu \mu \eta, \text{ line.})$ 

cc. Lateral line pale; mouth rather large, the maxillary reaching past front of eye.
d. Vertebræ normal. (Gadus.)

# 1239. G. callarias L.—Common Cod-fish.

Greenish or brownish, subject to many variations, sometimes yellowish or reddish; back and sides with numerous rounded brownish spots; lateral line pale; fins dark. Head large, but varying much in size; maxillary about reaching middle of orbit; occipital keel not greatly developed; teeth strong, cardiform, in narrow bands, those of the outer row in the upper jaw, and of the inner row in the lower jaw, somewhat Eve moderate, about half length of snout. First dorsal little elevated, its height about half length of head; vent under front of second dorsal; caudal slightly emarginate; pectorals half length of Head 3½ to 4½; depth about 4. D. 14-21-19; A. 20-18. Northern Seas, south to Virginia, Oregon, and Japan, one of the most important of all food-fishes. The fish of the Pacific Ocean (var. macrocephalus) is said to have the air-bladder ("sounds") smaller; it is wholly similar externally. The Greenland form (var. ogac) is very dark, with slender caudal peduncle, longer barbel, larger eye, broader interorbital space, longer pectorals, and more advanced ventrals. Great variations occur in size of head and in color among individuals from different regions.

(Gadus callarias et morrhua Linn. Syst. Nat.; Günther, iv, 328: Morrhua americana Storer, Hist. Fish. Mass. 343: Gadus macrocephalus Tiles. Mem. Acad. Sci. St. Petersb. ii, 360, 1810: Gadus macrocephalus Günther, iv, 330: Gadus ogak Richardson, F. B. A. Fish. 246: Gadus ogac Bean, Bull. U. S. Nat. Mus. xv, 110: Gadus auratus Cope, Proc. Am. Philos. Soc. Phila. 1873.)

dd. Vertebræ peculiarly modified, somewhat as in Merlucius. (Tilcsia\* Swainson.)

## 1240. G. gracilis Tiles.

Dusky bluish above, yellowish white below, without spots. Form of a haddock, the body subterete, compressed, the belly prominent. Head oblong, the snout rounded and depressed; upper jaw longer and broader than lower; barbel moderate; outer teeth setaceous; eye large. Scales very small, little imbricated. First dorsal subtriangular; second dorsal lower; third obtusely triangular; pectorals large; ventrals with the second ray produced; caudal equal. Head  $4\frac{1}{6}$ ; depth  $4\frac{1}{6}$ . D. 14-17-19; A. 21-20; P. 19; V. 6; B. 6. (Pallas.) Alaska to Japan. An insufficiently-described species, which, according to Dr. Bean, who has lately obtained it in Bering's Sea, is very distinct from the other members of the genus. It differs from Gadus callarias in the structure of its ver-

<sup>\*</sup>Swainson, Nat. Hist. Fish. etc. 1839, 300: type Gadus gracilis Tiles. (Dedicated to William Theophilus Tilesius.)

tebræ, resembling the structure found in *Merlucius*. This difference, in Dr. Bean's opinion, may necessitate the revival of the genus *Tilesia* of Swainson.

(Gadus gracilis Tilesius, Mem. Acad. Imp. St. Petersb. ii, 354, 1810: Gadus wachna Pallas, Zoogr. Ross.-Asiat. iii, 182, 1811: Tilesia gracilis Swainson, l. c.: Tilesia gracilis Bean, Proc. U. S. Nat. Mus. 1881, 243).

bb. Vent in front of second dorsal; species of small size. (Microgadus\* Gill.)

## 1241. G. proximus Grd.—Tom-cod.

Olivaceous above, pale, or slightly translucent, white below; dorsal fins dusky, paler at base; first anal, and ventrals uncolored; second anal dusted with dark points. Head long, convex above, somewhat compressed, with vertical sides; eye moderate, about 5 in head; mouth rather large; maxillary reaching to below pupil; barbel small; teeth in each jaw in a band, the outer row a little enlarged. Gill-membranes a little connected, free from the isthmus. First dorsal highest, somewhat falcate, its height three-fifths length of head; first anal longer and higher than second; pectorals moderate, reaching anal; ventrals filamentous, searcely reaching anal; eaudal slightly emarginate. Lateral line very distinct, wavy, high anteriorly, slightly interrupted posteriorly. Vent below first dorsal. Head 4; depth 4\frac{3}{3}. D. 14-18-19; A. 21-21; V. 6 or 7. L. 1 foot. Monterey to Alaska; abundant; a food-fish of some importance.

The Tom-cods (*Microgadus*) differ considerably from the true cods (*Gadus*) in the structure of the cranium. The following is Professor Gill's account of the skull of *G. proximus*, the italicised portions indicating the differences from *Gadus callarias*:

"The cranium is proportionally broader towards the front and less flattened, while the brain-case is flattened below, decidedly swollen on each side of a depressed sphenoidal groove, and has an ovate cardiform shape; the paraoccipital or epiotic is not produced into an angle behind, but is obtusely rounded, and its posterior or outwardly-descending ridge blunt; the opisthotic is well developed, oblong, and with its re-entering angle high up, and, on a line with it, the surface is divided into two parts—a narrow and flattened one, and a lower expanded one, much swollen; the alisphenoid or pro-otic is oblong, acutely emarginate in front, swollen from the region of the high anterior sinus, and above a little produced forwards; the great frontal is a little longer

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1865, 69: type Gadus proximus Grd. ( $\mu\nu\kappa\rho\delta$ 5, small;  $\nu\kappa\delta$ 05, Gadus.)

than broad, with supraoccipital crest continued forwards on the bone, and near the front expanded upwards, and with the expanded portion behind dividing into narrow lateral wings; the lateral testiform ridges of the frontal are continued forwards and curved outwards towards the antero-lateral angles; the anterior frontals are mostly covered in front by the great frontal, and are much developed in the direction of the antero-lateral angles, the inferior expanded axillary portion being very narrow; the nasal has a rounded ridge in front, continued well below, and its posterior crest is laminar and trenchant."

(Gadus proximus Grd. Proc. Acad. Nat. Sci. Phila. 1854, 141, and in U. S. Pac. R. R. Surv. 142: Morrhua californica Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 9: Gadus californicus Günther, iv, 332: Microgadus proximus Gill.)

## 1242. G. tomcod Walb.—Tom-cod: Frost-fish.

Olive brown, distinctly blotched and spotted with darker, lighter on the belly; more opaque than in G. proximus; back and sides profusely punctulate; dorsals and caudal blotched with darker; anals coarsely punctulate anteriorly, colorless posteriorly; ventrals and pectorals dusky. Snont rounded, less produced than in G. proximus; mouth short; maxillary  $2\frac{1}{2}$  in head, reaching pupil; eye large,  $3\frac{2}{3}$  in head; barbel small; pectorals reaching vent; ventrals filamentous, not reaching vent. Vent under interval between first and second dorsals. Head  $3\frac{2}{3}$ ; depth 5. D. 13-17-18; A. 20-17. L. 11 feet. Virginia to Labrador; common northward.

(Gadus tom-cod Walbaum, Artedi, Pisc. 1792, 133: Morrhna pruinosa Storer, Fish. Mass. 357: Gadus tomcodus Günther, iv, 331: Microgadus tomcodus Gill.)

au. Lower jaw projecting; barbel small, sometimes obsolete.

e. Upper jaw with its teeth subequal. (Pollachius Nilss.\*)

## 1243. G. virens L.—Pollack; Coal-fish; Green Cod.

Greenish brown above; sides and below somewhat silvery; lateral line pale; fins mostly pale; sometimes a black spot in the axil. Body rather elongate, compressed; snout sharp and conic; mouth rather small, oblique; maxillary reaching beyond front of orbit; lower jaw slightly the longer; teeth in the upper jaw nearly equal, the onter series not being especially enlarged; barbel rudimentary or obsolete. Gill-membranes considerably united, free from isthmus. Vent under first dorsal. Caudal fin lunate. Pectorals short, scarcely reaching

<sup>\*</sup>Nilsson; Bonaparte, Catologo Metodico, 1846, 45: type Gadus polluchius L.  $(\pi o \lambda \lambda \lambda \tilde{\omega}) \chi$ , many-fashioned; an old name, with no obvious application; perhaps merely a latinized form of the common name.)

anal; ventrals short. Head 4; depth 4¼. D. 13-22-20; A. 25-20; Lat. l. about 150; vertebræ 54. North Atlantic; common northward on both coasts.

(Gadus virens and G. carbonarius Linn. Syst. Nat.: Merlangus purpureus Storer, Fish. Mass. 358: Gadus virens Günther, iv, 339: Pollachius carbonarius Gill.)

#### 1244. G. chalcogrammis Pallas.

Blackish above, with silvery luster; everywhere punctulate with black; fins also punctulate; ventrals and first anal pale. Snout conic, sharp, rounded in profile; mouth oblique; maxillary reaching middle of pupil; chin with a minute barbel; teeth small, those of the outer row above slightly enlarged; eye large, wider than the flat interorbital space, 4 in head. Gill-membranes somewhat united, the posterior outline deeply emarginate; vent under interspace between first and second dorsal; first dorsal higher than the others, the second lowest; ventrals filamentous, reaching two-thirds distance to vent; pectorals long, reaching past front of anal; caudal somewhat concave. Head 4; depth 5. D. 12–17–18; A. 18–18; V. 7. North Pacific, south to Monterey.

(Gadus chalcogrammus Pallas, Zoogr. Ross.-Asiat. iii, 198, 1811-1831: Gadus periscopus Cope, Proc. Amer. Phil. Soc. Phila. 1873: Gadus chalcogrammus Günther, iv, 340.)

ee. Upper jaw with an outer series of rather larger teeth. (Borcogadus\* Günther.)

### 1245. G. saida Lepechin.

Brownish above, silvery below; head, body, and fins minutely dotted with black; the dorsals and pectoral almost entirely black, as is the lower half of the anal fins; lateral line pale. Barbel minute or absent; teeth extremely minute, sharp, those in the outer series a trifle larger; snout longer than eye, which is equal to interorbital space, and about one-fourth head; body clongate; tail slender; caudal deeply forked, the upper lobe the longer; ventrals long,  $1\frac{1}{3}$  in head; pectorals  $1\frac{1}{2}$ ; vent below front of second dorsal. Scales very minute, non-imbricate. Head  $3\frac{3}{3}$ ; depth  $5\frac{1}{2}$ . D. 13-15-21; A. 16-21. (Collett.) Greenland to Alaska and Russia.

(Gadus saida Lepechin, Nov. Comm. Acad. Scient. Petrop. 1774, 512: Gadus saida Giinther, iv, 337; Collett, Norske Nord-Havs Exp. 1880, 126: Merlangus polaris Sabine, App. Parry's Voyage, cexi, 1824: Gadus fabricii Rich. Fanna Bor.-Amer. iii, 245: Gadus fabricii Giinther, iv, 336: Boreogadus polaris Gill, Proc. Acad. Nat. Sci. Phila. 1863, 233: Boreogadus saida Bean, Bull. U. S. Nat. Mus. iv, 108: ? Gadus pygmaus Pallas, Zoogr. Ross.-Asiat. iii, 190, 1811: Gadus ayilis Reinh. Kgl. D. Vid. Selsk. 1838, 126: ? Gadus glacialis Peters, Nord-Pol Exp. ii, 172, 1874.)

<sup>\*</sup> Günther, Cat. Fish. Brit, Mns. iv, 336, 1862: type Gadus fabricii Rich. (βορεος, northern; Gadus.)

#### 444.-HVPSICOMETES Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, 347; type Hupsicometes gobioides Goode.)

Body elongate, covered with large scales; mouth rather small, horizontal, the lower jaw much projecting; 2 or 3 rows of feeble teeth on jaws and vomer; none on palatines. Eyes large, superior, near together. No barbel; no pseudobranchiæ. Caudal fin separate; 2 dorsal fins, the first of a few long rays, the second with a longer base, entire, and similar to the anal; ventrals well developed, each of 6 rays. Deep-sea fishes. ( $\delta\psi i$ , in deep water;  $z\omega\mu\eta\tau\eta s$ , dweller.)

### 1246. H. gobioides Goode.

Color grayish, clouded with darker; belly pale; a large dark blotch at base of upper rays of caudal. Head rather broad and depressed, its width about equal to greatest depth of body; maxillary reaching front of orbit; snout broad, rounded, as long as eye. Caudal truncate; longest rays of first dorsal as long as the snout; ventrals wide apart, with broad bases, inserted far in advance of the pectorals. Head 3; depth 8. D. 6-17; A. 16; V. 6; Lat. 1. 58. L. 2 inches. Gulf Stream, off the coast of Rhode Island. (Goode.)

(Goode, Proc. U. S. Nat. Mus. iii, 348, 1880.)

## 445 .- MERLUCIUS Rafinesque.

### Hakes.

(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc. 1810, 26: type Gadus merlucius L.) Body elongate, covered with small decidnous scales. Head slender, conical, the snout long, depressed; a well-defined, oblong, triangular excavation at the forehead, bounded by the ridges on the separated frontal bones; these ridges converge backwards into the low occipital crest; eye rather large; edge of preopercle free; preopercle with a channel behind its crest, crossed by short radiating ridges; month large, oblique; maxillaries extending to opposite the eyes; lower jaw longest; no barbels; jaws with slender teeth, of various sizes, in about 2 series, those of the inner row longer and movable; vomer with similar teeth; palatines toothless. Branchiostegals 7. Gill-rakers long; gill-membranes not united. Dorsal fins 2, well separated, the first short, the second long, with a deep emargination: anal emarginate, similar to second dorsal; ventral fins well developed, with about 7 rays; vertebræ peculiarly modified, the neural spines well developed and wedged into one another; frontal bone double and the skull otherwise peculiar in several respects. Species several, very similar. Large, voracious fishes, little valued as food. (*Merlucius*, the ancient name, meaning "Sea-Pike.")

## 1247. M. bilinearis (Mitch.) Gill.—Hake.

Grayish, darker above, dull silvery below; axil and edge of pectoral somewhat blackish; inside of opercle dusky silvery; inside of month dusky bluish; peritoneum nearly black. Top of head with the W-shaped ridges very conspicuous; eye shorter than snout, and less than interorbital width; maxillary reaching posterior border of pupil; teeth not very large, smaller than in *M. smiridus*. Scales larger than in other species; pectorals and ventrals long, the latter reaching three-fourths distance to vent, their length about three-fifths that of head. Head  $3_4^3$ ; depth  $6_2^4$ . D. 13-41; A. 40; Lat. l. 100-110. Coasts of New England and northward; rather common.

(Stomodon bilinearis Mitchill, Rept. Fish. N. Y. 7, 1814: Gadus albidus Mitchill, Jonrn. Acad. Nat. Sci. Phila. i, 409: Merlucius albidus Storer, Hist. Fish. Mass. 363; Goode & Bean, Bull. Essex Inst. xi, 9.)

## 1248. M. smiridus Raf.-European Hake.

Dusky above, silvery below; dorsal, caudal, and distal part of pectoral blackish; inside of opercle black; inside of mouth black posteriorly, pale in front; peritoneum black. Ventrals a little more than half head; teeth very long. Head large,  $3\frac{1}{3}$ ; depth  $6\frac{1}{2}$ . D. 10–36; A. 36; vert. 25+26; Lat. l. 150. Coasts of Europe; abundant; straying to Greenland. Here described from specimens taken at Genoa. The identity of the northern species with M, smiridus is perhaps uncertain.

(Gadus merluccius L. Syst. Nat.; Rafinesque, Caratteri di Alcuni Nuovi Generi, 1810, 26: Merlucius vulgaris Fleming, Brit. Anim. 193: Merlucius vulgaris Günther, iv, 344: Epicopus gayi Günther, ii, 248.)

## 1249. M. productus (Ayres) Gill.—Merluccio.

Silver gray; head dusted with coarse black dots; inside of month and opercle jet black; peritoneum silvery, with black specks. Head with the W-shaped ridges less strongly marked; maxillary reaching center of pupil; eye large; pectorals long and narrow, reaching vent; ventrals much smaller than in M. bilinearis, reaching half way to vent; their length about  $\frac{2}{5}$  that of head; caudal somewhat forked. Scales quite small, deciduous. Teeth moderate. Head  $3\frac{3}{4}$ ; depth 7. D. 11–41; A. 43; V. 7. Lat. l. 136. L. 3 feet. Pacific coast, from Santa Barbara northward; abundant.

(Merlangus productus Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 64: Homalopomus trowbridgii Girard, Proc. Acad. Nat. Sci. Phila. 1856, 132: Gadus productus Günther, iv, 338; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 247.)

#### 4.16.—CHIASMODON Johnson.

(Johnson, Proc. Zool. Soc. Lond. 1863, 408: type Chiasmodou niger Johnson.)

Body elongate, compressed, and tapering posteriorly, naked; belly pendent, its walls membranaceous, capable of great dilation. Mouth very large; lower jaw longer than upper, without barbel; both jaws with two series of large, pointed teeth, some of the anterior being very large and movable; vomerine teeth none; palatines with teeth similar to those in the jaws. Gills 4. No pseudobranchiæ. Gill-openings very wide, the membranes joined to the isthmus for a short distance. Dorsal fins two; anal single; ventrals inserted below pectorals, each of five soft rays. Tail not isocercal, truncate at base of caudal. Caudal forked, free from dorsal and anal. Singular fishes of the deep sea, remarkable for their ability to swallow fishes of many times their own size by means of the great distensibility of the walls of the body. The position of this genus in the family Gadidæ is doubtful. (χιάσμα, a mark of the form of the letter X; νδων, tooth; the two anterior canines crossing each other when depressed.)

## 1250. C. miger Johnson.

Entirely black. Head compressed, elongate, the crown flat, its depth less than half its length; maxillary reaching angle of preopercle; both jaws armed with long, pointed, wide-set teeth, nearly all of which are movable; two anterior teeth of upper jaw very long, crossing each other when depressed; three anterior pairs of teeth in lower jaw likewise prolonged, the third pair the longest; palatines with a longer, fixed tooth Eye moderate, above the anterior part of maxillary, 41 in head, shorter than snout, as wide as interorbital space. Lateral line in a longitudinal groove. First dorsal of slender rays, its base  $2\frac{1}{3}$  in that of second dorsal; anal commencing behind second dorsal, its anterior rays without connection with vertebral column; posterior rays of anal and dorsal very feeble; pectoral as long as head without snout; ventral half as long as pectoral. Head  $3\frac{1}{2}$ . D. 11-28; A. 27; P. 13; V. 5. Deep seas; taken at Madeira and off the L. 12 inches. (Günther.) coast of Massachusetts.

(Johnson, l. c. 408: Chiasmodus niger Günther, v, 435.)

# FAMILY CXXI.—MACRURIDÆ.

(The Grenadiers.)

Body elongate, tapering into a very long compressed tail, which ends in a point; scales moderate, very rough, usually keeled or spinous.

Teeth villiform or cardiform, in bands, on the jaws only; tip of lower jaw with a barbel; premaxillary protractile. Dorsals two, the first short and high, of stiff, spine-like branched rays; the second dorsal very long, of very low feeble rays, continued to the end of the tail; anal fin similar to the second dorsal, but much higher; no candal fin; ventrals small, subjugular, each of about 8 rays. Branchiostegals 6 or 7. Lateral line present. Gills 4, a slit behind the fourth. Gillrakers very small; gill-membranes narrowly united to the isthmus; no pseudobranchiæ; pylorie eæca numerous; air-bladder present. Genera about 5; species about 15, chiefly of the northern seas, in deep water. (Macruridæ Günther, iv, 390-398.)

- a. Scales of moderate size.
  - b. Snout produced, conical; cleft of mouth entirely inferior....MACRURUS, 447.
  - bb. Snout short, obtuse, truncated; cleft of mouth lateral.

    CORYPHENOIDES, 448.

#### 447.-MACRURUS Bloch.

(Lepidoleprus Risso.)

 $({\it Macrourus}~{\rm Bloch, Ichth.~v,~152, 1787:~type~{\it Macrourus~rupestris}~{\rm Bloch, not~of~Gunner.})$ 

Snout broadly conical, high, projecting beyond mouth; mouth moderate, its eleft horizontal, **U**-shaped, entirely inferior; teeth of the outer series not enlarged; head sometimes with roughened bony ridges, one of which, on the suborbital and preorbital, simulates the suborbital stay of the Cottoids; eyes very large; scales very rough, keeled, the keels usually ending in spines. Deep water fishes; mostly northern. This genus grades into the next, and is perhaps unworthy of retention. (µazyoz, long; ôvpá, tail.)

a. Suborbital region with a conspicuous bony ridge extending from the preopercle along the suborbital and preorbital to the end of the projecting snout.

## 1251. M. fabricii Sundevall.—Rat-tail; Grenadier.

Dusky, inside of month and gill-openings black; peritoneum black. Snont sharp, nearly as long as eye,  $3\frac{1}{2}$  in head; an area of loose, roughish, naked skin between the suborbital ridge and the month; supraocular and occipital ridges present, the interocular space concave. Scales each with a longitudinal serrate ridge ending in a spine; first ray of dorsal denticulated toward the tip; vent behind origin of second dorsal; 5 rows of scales between first dorsal and lateral line. Head  $4\frac{1}{3}$ ; depth 6. Eye 3 in head. D. 12–124; A. 148; V. 8; Lat. l. ca. 125. Massachusetts to Greenland and Norway, in deep water; not rare.

(Coryphana rupestris Müller, Zool. Dan. Prodr. 1776, 443 (not of Gunner): Macrourus rupestris Bloch, i, 152: Macrurus rupestris Günther, iv, 390: Macrurus fubricii Sundevall, Vet. Akad. Handl. 1840, 6.)

#### 1252. M. carminatus Goode.

Silver-gray. Body stouter than in *M. bairdi*, the tail less attenuate. Scales heavy, covered with long spines arranged in nine or ten rows, like wool-cards (carmen), those of the middle row similar to the others. Eye as deep as width of interorbital space, 5 in head. Snout long, sharp, depressed, triangular, 3 in head, its lateral ridges well developed, running in a straight line under the eyes; a strong horizontal ridge from supraorbital to gill-openings parallel with subocular ridges; barbel very short. Long ray of dorsal unarmed; anal rather high, its longest rays equal to half width of interorbital space; pectoral not reaching anal; ventral behind pectoral, its filament not reaching anal. Head 5; depth 8. D. 10–80+; A. 76+; P. 13; V. 7; scales ca. 5–100–12. Gulf Stream, off the coast of Rhode Island. (Goode.)

(Goode, Proc. U. S. Nat. Mus. 1880, 346.)

aa. Suborbital region without conspicuous bony ridge.

### 1253. M. bairdi Goode & Bean.

Brownish gray, bluish below; membrane of first dorsal and under surface of snout pink; throat and branchiostegals deep violet; front of dorsal and anal blackish. Snout sharp, quadrate, shorter than eye, with 4 radiating ridges; bony ridge of preorbital and suborbital obsolete, this region unarmed and soft to the touch; mouth less distinctly inferior than in other species. Scales keeled; first long ray of first dorsal strongly serrate anteriorly; vent under middle of first dorsal. Head 6½; depth 8. D. 12–137; A. 120; scales 6–152–20. Deep water, off the coast of New England. This species approaches Coryphænoides, and renders the distinction of the genus Macrurus doubtful.

(Goode & Bean, Amer. Journ. Sci. Arts, xiv, 471, 1877.)

### 448.—CORYPHÆNOIDES Gunner.

(Gunner, Troudhj. Selsk. Skrift. iii, 50, 1765: type Coryphanoides rupestris Gunner.)

Snout short, obtuse, high, obliquely truncated, soft to the touch, except its bony center; cleft of the mouth lateral; head without prominent ridges, the membrane bones of the side of the head soft and papery; teeth in the outer series of upper jaw somewhat enlarged. Scales smooth or spinous. Lower jaw with a barbel. (zapoψαίνα, Coryphæna; ἐίδος, resemblance.)

## 1254. C. rupestris Gunner.

Bones of front and sides of head thin and papery; no bony ridges on sides of head; angle of preopercle with a conspicuous four-angled process. Eyes very large, longer than snout,  $3\frac{1}{3}$  in head; maxillary extending to below posterior edge of pupil. Pectorals inserted above ventrals and below first ray of dorsal, which is strong, compressed, and armed anteriorly with sharp teeth directed upward; vent under last ray of first dorsal. Scales small, rough, but not keeled. Head 4; depth  $5\frac{1}{2}$ . First D. 11; A. ca. 110; V. 8. Banks of Newfoundland to Norway, in deep water.

(Coryphanoides rupestris Gunner, Trondlij. Selsk. Skrift. iii, 50, 1765: Coryphanoides norvegicus Günther, iv, 396: Macrourus norvegicus Nilsson, Skand. Fauna Fiske 600, 1832: Macrourus strömi Reinh. Dansk. Vidensk. Afhandl. vii, 129.)

# ORDER U.—HETEROSOMATA.

(The Flat-fishes.)

"Cranium posteriorly normal; anteriorly with twisted vertex, to allow two orbits on the same side, or one vertical and one lateral; basis cranii not quite simple. Dorsal fin long, of jointed rays. Superior pharyngeals 4, the third longest, much extended forward, the inferior separate." (Cope.) This order includes the single family of Pleuronectides. ( $\xi \tau \varepsilon \rho \sigma \varepsilon$ , different;  $\sigma \tilde{\omega} \mu a$ , body.)

(Anacanthini pleuronectoidei Günther, iv, 399-504.)

# FAMILY CXXII AND CXXIII.—PLEURONECTIDÆ.

(The Flounders.)

Body strongly compressed, oval or elliptical in outline; head unsymmetrical, the cranium twisted, both eyes being on the same side of the body, which is horizontal in life, the eyed side being uppermost and colored, the blind side lowermost and usually plain. In very young fishes the bones of the head are symmetrical, one eye on each side, and the body vertical in the water. In some species the cranium becomes twisted, bringing the upper eye over with it; in others the upper eye moves through the cranium. Month small or large, the dentition various; premaxillaries protractile; no supplemental maxillary bone; pseudobranchiæ present. Gills 4, a slit behind the fourth; lower pharyngeals separate; no air-bladder; vent not far behind head. Scales various, rarely absent, usually small. Lateral line usually present, extending on the caudal fin, sometimes duplicated or wanting. Dorsal fin long, continuous, of soft rays only, beginning on the head; anal

similar, shorter; caudal various, sometimes coalescent with dorsal and anal; pectorals inserted rather high, sometimes wanting; ventrals under the pectorals, usually of several soft rays, sometimes wanting. Fishes mostly carnivorous, inhabiting sandy bottoms in all seas, some species ascending rivers. Many of them are important food-fishes. Genera about 40; species nearly 400.

(Pleuronectida Günther, iv, 399-504.)

- a. Pectoral and ventral fins both present; caudal distinct; margin of preopercle more or less free.
  - b. Mouth large; teeth nearly equally developed on both sides of the mouth.
    - c. Ventral fin of the left side inserted nearly on the ridge of the abdomen; body sinistral.
      - d. Vomer with teeth; lateral line arched in front; scales small or obsolete.

Вотния, 449.

- ec. Ventral fins both lateral; vomer and palatines toothless.
  - e. Candal fin lunate.
    - - q. Teeth not arrow-shaped; gill-rakers few, short.

Platysomatichthys. 452.

gg. Teeth arrow-shaped; gill-rakers numerous, long.

ATHERESTHES, 453.

- ee. Caudal fin not lunate, the middle rays produced.
  - h. Lateral line arched in front; body usually sinistral.

Paralichthys, 454.

hh. Lateral line not arched; body dextral.

HIPPOGLOSSOIDES, 455.

- bb. Month small; teeth, if present, most developed on the blind side.
  - j. Teeth small, acute, in several series; lateral line nearly straight, with an accessory branch; scales small, eyeloid; eyes dextral.

    - kk. Lips simple; dorsal fin beginning on the median line.

Hypsopsetta, 457.

- jj. Teeth in one series.
  - l. Teeth rather large, bluntish or trenchant; eyes dextral (sometimes sinistral in one species); ventrals (usually) both
    - m. Dorsal fin with less than 80 rays; anal with less than 60.

PLEURONECTES, 458.

- mm. Dorsal fin with more than 95 rays; anal with more than 80; body unusually elongate.

- aa. Pectoral fins one or both reduced or wanting; margin of preopercle usually not free.
   vertical fins free from the candal.
  - p. Eyes sinistral; caudal subsessile; left pectoral only present; lateral line present, arched on eyed side, straight on blind side..........MONOLENE, 463.

  - oo. Vertical fins confluent around the pointed tail; body sinistral; no pectoral fins; one ventral present; eyes yery small.

## 449.-BOTHUS Rafinesque.

#### Turbots.

(Rhombus Cuvier, not of Lacépède: Lepidorhombus Gthr.: Scophthalmus Raf.: Lophopsetta Gill.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi, 1810, 23: type Bothus rumolo Raf. = Pleuronectes rhombus L.)

Eyes and color on the left side. Body broadly ovate, strongly compressed; mouth large, oblique, the maxillary reaching to beyond eye; teeth subequal, in villiform or cardiform bands, sometimes in single series; a small patch of teeth on the vomer. Scales small, etenoid or cycloid, sometimes obsolete; skin sometimes with bony tubercles. Lateral line strongly arched in front, without accessory branch. Dorsal fin beginning on the snout; anal fin not preceded by a spine; ventral of left side free from the anal, inserted nearly on the ridge of the abdomen, its base broad, the rays well separated. Species sometimes of large size, mostly of the Atlantic. ( $\beta u\theta az$ , deep.)

a. Scales developed, cycloid; no bony tubereles. (Bothus,\*)

## 1255. B. maculatus (Mitch.) J. & G .- Sand-flounder; Window-pane.

Light olive brown, almost translucent, everywhere marbled with paler, and with many roundish irregular blackish blotches; fins spotted. Body broadly rhomboid, very strongly compressed; interorbital area flattish; eye rather large, about equal to snout; teeth in both jaws in one series laterally, in a very narrow band in front; maxillary nearly half length of head. Gill-rakers rather long and slender, numerous, about 25 below the angle of the arch. Scales well developed,

<sup>\*=</sup> Lophopsetta Gill, Proc. Acad. Nat. Sci. Phila. 1862, 216: type Pleuronectes maculatus Mitchill.

cycloid, loosely imbricated; those of the blind side a little smaller; no bony tubercles; vertical fins scaly. Anterior rays of dorsal elevated, branched, with free tips. Head  $3\frac{3}{4}$ ; depth  $1\frac{3}{5}$ . D. 65; A. 52; Lat. l. 85. L. 18 inches. Atlantic coast of United States, very common northward; size rather small.

(Pleuronectes maculatus Mitch. Rept. in Part Fish. N. Y. 1814, 9: Pleuronectes aquosus Mitch. Trans. Lit. & Phil. Soc. i, 389, 1815: Rhombus aquosus Günther, iv, 411: Lophopsetta maculata Gill, Proc. Acad. Nat. Sci. Phila. 1862, 216.)

#### 450.—CITHARICHTHYS Bleeker.

(Hemirhombus Bleeker: Orthopsetta and Metoponops Gill.)

(Bleeker, in Günther, iv, 420, 1862, and in Compt. Rend. Acad. Sci. Amsterdam, xiii, 1862: type Citharichthys eayennensis Bleeker.)

Eyes and color on the left side. Body oblong; mouth of the large type, but comparatively small, with one or two series of small, sharp teeth in each jaw; no teeth on vomer or palatines. Gill-rakers moderate, slender. Dorsal fin beginning just in front of eye; all the fin rays simple; ventrals of colored side on the ridge of the abdomen; no anal spine; caudal fin convex or double-truncate behind. Scales thin, slightly etenoid. Lateral line nearly straight, simple. Lower pharyngeals separate, each with a single row of teeth. (Citharus, an allied genus;  $i\chi\theta\delta\varepsilon$ , fish—a fish which lies on its  $zi\thetaa\rhou\varepsilon$  or ribs—that is, on its side.)

- a. Teeth in upper jaw in two rows. (Hemirhombus\* Bleeker.)
  - b. Interorbital space broad; left pectoral filamentous.

### 1256. C. aramaca (Cuv.) J. & G.

Light-brown, with blackish blotches; fins mottled; left pectoral barred. Body elliptic-ovate, the anterior profile regularly decurved, forming an angle above the snout. Mouth rather large, arched; maxillary  $2\frac{3}{3}$  in head, extending to below eye; teeth in upper jaw in two series, some of the outer forming small canines; lower teeth in one row. Eye large, 4 in head; lower eye in advance of upper, especially in the adult; interorbital space broad, concave, as broad as eye in adult, much narrower in the young. Gill-rakers short, flattish. Dorsal rather low, the longest rays  $2\frac{1}{4}$  in head; anal without spine; pectoral of left side with two filamentous rays, its length  $1\frac{1}{4}$  to 2 times head. Scales small, thin, weakly ciliate, with smaller ones intermingled. Head  $3\frac{3}{3}$ ; depth

<sup>\*</sup> Bleeker MSS. Günther, Cat. Fish. Brit. Mus. iv, 423, 1862: type Hemirhombus quincensis Bleek. ( $\acute{\epsilon}\mu_I$ , half;  $\acute{\rho}o\mu\beta$ 05, Rhombus.)

#### 479.-HIMANTOLOPHUS Reinhardt.

(Corynolophus Gill.)

(Reinhardt, Dansk, Vidensk, Selsk, Nat. 1837, 74: type Himantolophus grænlandicus Reinhardt.)

Body and head oval, compressed. Skin more or less prickly. Mouth moderate, the cleft oblique, the joint of the mandible below the eyes. Gills in  $\frac{1}{2}2\frac{1}{2}$  pairs; gill-arches armed with dentigerous tubercles. Spinous dorsal represented only by a single long rostral spine, the basal element of which is procumbent and subcutaneous. Greenland. ( $i\mu\tilde{a}_{5}$ , a thong;  $\lambda a_{5} c_{5}$ , tuft.)

## 1310. II. grænlandieus Reinh.

Body oblong-oval. Cephalic ray provided with about 11 tentacles. Depth  $2\frac{1}{2}$ . D. I-9; P. 12. Greenland. (Gill.)

(Reinhardt, l. c. 74; Gill, Proc. U. S. Nat. Mus. 1878, 218.)

#### 1311. H. reinhardti Lütken.

Body short-oval. Cephalic ray  $\frac{2}{3}$  length of head, with about 8 tentacles. Skin sparsely covered with thorn-like prickles. Depth  $1\frac{1}{3}$ . D. I-5; P. 17. Greenland. (Gill.)

(Lütken, Kong. Dansk. Vidensk. Selsk. 1878, 321: Corynolophus reinhardti Gill, I. c. 219.)

## FAMILY CXXVI.—MALTHIDÆ.

(The Bat-fishes.) -

Head very broad and depressed, the snout more or less elevated, the trunk short and slender. Mouth not large, subterminal or inferior, the lower jaw included; teeth villiform or cardiform. Gill-openings very small, above and behind the axils of the pectoral fins. Body and head covered with bony tubercles or spines. Spinous dorsal reduced to a small rostral tentacle, which is retractile into a cavity under a prominent process on the forehead; in one genus the rostral tentacle is obsolete; soft dorsal and anal fins small and short; ventrals well developed; pectoral fin well developed, its base strongly angled, with long pseudobrachia and 3 actinosts. Branchiostegals 5; no pseudobranchiæ. Genera 3; species about 10; chiefly American.

(Pediculati part; genera Malthe and Halicutwa Giinther, iii, 200-205.)

- a. Snout produced; teeth on jaws, vomer, and palatines; mouth small.
- - c. Mouth small; rostral tentacle obsolete; teeth on vomer and palatines.

LATTEUTICUTUS 474

ec. Month wide; rostral tentacle present; no teeth on vomer or palatines.

HALIEUTEA, 475.

#### 473.-MALTHE Cuvier.

#### Sea Bats.

(Cuvier, Règne Animal, ii, 1817: type Lophius respertilio L.)

Body stoutish; head very broad and depressed, triangular in form, the forehead elevated and produced. Mouth rather small, sub-inferior; villiform teeth in bands, on jaws, vomer, and palatines. Skin with conical, bony protuberances. Dorsal and anal fins very small; rostral tentacle present, retractile into a cavity under a bony prominence on the forehead; ventrals present, I, 5, well separated. No air-bladder; no pyloric cœca. Coasts of America.  $(\mu \hat{a} \lambda \theta_{7})$ , a name of some soft-bodied fish.)

## 1312. M. vespertilio (Linn.) Cuv.—Bat-fish.

Pale grayish brown above, reddish below. Distance between the anterior angles of orbits much less than that between the posterior angles; forehead produced in a sub-conical process, which is variable in length but longer than in the other species, about  $\frac{1}{10}$  of total length; rostral groove longer than broad. D. 4; A. 4. L. 6 inches. Atlantic coasts of America, chiefly southward.

(Lophius respertilio Linn. Syst. Nat.; Günther, iii, 200.)

Subsp. masuta (Cuv. & Val.) J. & G.

Dusky above, with round, black spots, edged with whitish. Rostral process short, about one-thirteenth of the length of the body; cavity of rostral tentacle higher than broad; vent behind middle of body; width across arms about half length of body. Head 2. D. 4; A. 4. South Atlantic coast of the United States.

(Malthwa nasuta and notata Cuv. & Val. xii, 452, 453: Malthe notata Liitken Naturh. Foren. Vidensk. Meddels. 1865, 4.)

#### 1313. M. enbifrons Rich.

Rostral cavity somewhat broader than high; distance between anterior angles of orbits about equal to that between the posterior angles; snout not produced beyond the rostral cavity, but with a cylindrical button-like tubercle slightly contracted at base, pointing obliquely upwards and forwards; caudal peduncle very thick and heavy. Head 2; width across arms 2. D. 4; A. 4. Coast of Florida; the original type said to have come from Labrador. Reaches a length of more than a foot.

(Richards, Faun. Bor.-Amer. Fish. p. 103; Günther, iii, 203.)

## 471. HALTEUTICHTHYS Poev.

(Poey, Proc. Acad. Nat. Sci. Phila, 1863, 89; type Halientichthys reticulatus Poey.)

Disk suborbicular, about as long as the rest of the body (including caudal fin); forehead with a transverse bony ridge, the cavity beneath it being without a tentacle; mouth rather small, inferior, the lower jaw nearly semicircular; teeth fine, on jaws and palate. Dorsal and anal fins with four rays each. (ààssəzə/5, fisher; izəbə, fish.)

## 1311. II. aculeatus (Mitch.) Goode.

Color gray, reticulated with blackish; caudal with three blackish bands. Disk longer than wide and somewhat narrowed anteriorly; ridges armed with simple spines; five bicuspid spines on each lateral margin of the disk, and between them smaller, simple ones; five spines forming a pentagon before interorbital area; one over each orbit, and 4 on a ridge behind each orbit. D. 4; A. 4. (Gill.) Cuba to Southern Florida.

(Lophius aculeatus Mitch, Amer. Monthly Mag. ii, 325, 1818; Halicutichthys reticulatus Poey M88., Gill, Proc. Acad. Nat. Sci. Phila. 1863, 91; Goode, Proc. U. S. Nat. Mus. ii, 109, 1879.)

### 475. HALIEUT EA Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. xii, 455, 1837: type Lophius stellatus Wald.)

Head very large, broad, depressed, its ontline nearly circular; cleft of the month wide, horizontal; jaws with small cardiform teeth; no teeth on vomer or palatines. Skin everywhere covered with small, stellate spines. Forehead with a transverse bony ridge, beneath which is a tentacle, retractile into a cavity, the only rudiment of the spinous dorsal fin; soft dorsal and anal very short, far back. Gills 2½, the anterior gill-arch without laminae. Branchiostegals 5; vertebrae 17. Warm seas. (ἀλωντής, one who fishes.)

## 1315. II. senticosa Goode.

Reddish gray, whitish below. Disk orbicular, nearly as broad as long, its ontlines prolonged on each side in a strong spine, armed at tip with a group of spinelets; skin above with numerous stout, conical stellated spines, largest posteriorly; a marginal series of close set spines, besides 5 to 7 on each carpal péduncle; outside of the marginal spines is a row of 5 depressed, knife-like spines, each with a crown of three spinelets; these two rows of marginal spines coalescing on the front edge of disk forming a bristling row, pointing in different directions; small stellate prickles in the interspaces of the larger spines

and on the ventral surface. Snout somewhat projecting, with three multifid spines; a ridge armed with spines across front of eyes over top of snout; four of these spines larger than others; rostral tentacle club-shaped, trilobate at tip; width of mouth equal to distance between centers of eyes. Head 2½; width of disk 2. D. I-6; A. 4; C. 8; P. 14; V. 5. Deep water off southern New England. (Goode.)

(Goode, Proc. U. S. Nat. Mus. 1880, 467.)

# ORDER W.—PLECTOGNATHI.

(The Plectognaths.)

Scapula suspended to the eranium by a posttemporal; premaxillaries usually coössified with the maxillaries behind, and the dentary bones with the articular; pharyngeal bones distinct; posttemporal coössified with the epiotic and undivided; interoperculum a slender rod; superior pharyngeals laminar, usually vertical and transverse; skin with rough scales or covered with shields or spines, sometimes naked; skeleton incompletely ossified, the vertebræ in small number; ventral fins reduced to a single spine or wanting; air-bladder without pneumatic duct. This group is a modified offshoot from Acanthopteri, its nearest relatives being the Chatodontidae and the Acanthwridae. ( $\pi \lambda \epsilon z \tau \delta z$ , braided or plaited;  $\gamma \nu \delta \theta o z$ , jaw.)

(Plectoquathi Günther, viii, 207-320.)

#### ANALYSIS OF FAMILIES OF PLECTOGNATHI.

- a. Jaws with distinct teeth.
  - b. Ventral fins obsolete.

    - cc. Teeth incisor-like; body with scales or movable plates; spinous dorsal present.

      Balistidæ, 128.
- aa. Jaws each modified into a sort of beak, without distinct teeth; no spinous dorsal.
   d. Body little compressed; vertical fins distinct.........Tetrodontidæ, 129.
   dd. Body much compressed; vertical fins more or less confluent around the tail.
   Orthagoriscidæ, 130.

# Family CXXVII.—OSTRACHDÆ.

(The Trunk-fishes.)

Body short, cuboid, triquetrous or pentagonal, covered by a carapace formed of firmly united six-sided plates, the jaws, bases of the fins, and caudal peduncle free and covered by smooth skin. Mouth small; each jaw with a single series of long, narrow teeth. Gill-opening a nearly

vertical slit, below and behind the eye. Dorsal fin single, short, without spine; anal short, similar to dorsal; caudal rounded; no ventral fins: vertebra 14, the anterior elongate, the last five extremely short; no ribs. Genera two: species about 20; chiefly of the tropical seas. "The locomotion of the trunk-fishes is very peculiar. The propelling force is exerted by the dorsal and anal fins, which have a half rotary, sculling motion, resembling that of a screw-propeller; the caudal fin acts as a rudder, save when it is needed for unusually rapid swimming, when it is used as in other fishes; the chief function of the broad pectorals seems to be that of forming a current of water through the gills, thus aiding respiration, which would otherwise be difficult on account of the narrowness and inflexibility of the branchial apertures. When taken from the water, one of these fishes will live for two or three hours, all the time solemnly fanning its gills, and when restored to its native element seems none the worse for its experience, except that, on account of the air absorbed, it cannot at once sink to the bottom" (Goode).

(Sclerodermi, group Ostraciontina, Günther, viii, 255-268.)

#### 476.—OSTRACIUM Linnaus.

(Ostracion, Artedi; Linnæus Syst. Nat. x, 330, 1758: type Ostracion cubicus Linnæus.)

Trunk-fishes with trigonal, tetragonal, or pentagonal carapace, the ventral surface never carinated; carapace closed behind the anal fin. Temperate and tropical seas; the trigonal species confined to the western Atlantic. (ὀστράχιον, diminutive of ὄστράχιον, any hard object, like the shell of a mollusk.)

a. Body three-angled. (Lactophrys Swainson.)
 b. No supraocular spine.

## 1316. O. trigonum Linn.—Trunk-fish.

Uniform brown, with numerous irregularly grouped whitish spots, most abundant on caudal peduncle; young specimens with a black blotch on sides behind gill-openings. Body three-angled; no spine before eyes. Each ventral ridge with a large, flat spine; dorsal ridge high and sharply compressed, descending rather rapidly forward and ending opposite posterior margin of orbit; carapace open behind the dorsal fin. Head 4 in length; height of sides 2. D. 10; A. 10. West Indies; occasional on our coast southward.

(Linnaus, Syst. Nat. x, 330, 1758; Günther, viii, 256; Goode, Proc. U. S. Nat. Mus. 1879, 276: Lactophrys trigonus Poey, Mem. Hist. Nat. Cuba, ii, 362, 1861.)

bb. Supraocular spines present, strong, directed forward. (Acanthostracium Bleeker.)

## 1317. O. quadricorne L.—Cow-fish; Cuckold.

Color brown, yellow, blue, or green, with irregular blue blotches; the centers of the scutes often lighter than the margins. Carapace trigonal; adults with a broad low ridge on each side of the back, the dorsal ridge more elevated than in the young, which are somewhat tetragonal. Ventral surface nearly flat; angles of body carinate; a stout spine directed forwards over each eye; abdominal spines flat, directed backward; median dorsal spine seldom present, never persistent; bridges behind dorsal and anal each ending in a flat spine; under side of candal peduncle with a free plate; carapace closed behind dorsal fin. Head  $4\frac{3}{4}$ ; depth  $2\frac{1}{3}$ . D. 10; A. 10. Tropical parts of the Atlantic; common on our coast southward.

(Linneus, Syst. Nat. x, 331, 1758; Günther viii, 257; Goode, Proc. U. S. Nat. Mus. 1879, 278.)

# FAMILY CXXVIII.—BALISTID.E.

(The Trigger-fishes.)

Body oblong, or ovate, more or less compressed, covered with rough scales or scutes of varying structure, the scutes not forming a carapace. Mouth small, terminal, low; jaws short, each with one or more series of separate incisor-like teeth; eye near the occiput; preorbital very deep. Gill-openings small, slit-like, above or in front of the pectoral fins. Dorsal fins two, the anterior of one to three spines, the first spine highest; second dorsal remote from the first, of many soft rays; caudal fin rounded or forked; ventral fins wanting, their place sometimes occupied by a single spine at the end of the very long, usually movable, public bone. Genera about 8; species about 100. Carnivorous fishes; inhabitants of the warm seas.

(Balistidæ, group Balistina, Günther, viii, 211-255.)

a. Dorsal spines three; body covered with thick scales or plates. (Balistina.)
 BALISTES, 477.

aa. Dorsal spine single or followed by a rudiment; skin with minute, rough scales. (Monacanthina.)

b. Ventral spine present; gill-slit short, nearly vertical; anal rays about 30.

Monacanthus, 478.

bb. Ventral spine obsolete; gill-slit long, oblique; anal rays about 40 to 50.

ALUTERA, 479.

## 477.—BALISTES Linnæus.

# Trigger-fishes.

(Artedi; Linnaus, Systema Naturæ, 1758: type Bulistes vetulus L.)

Body compressed, covered with thick, rough scales or plates. Both

jaws with incisor-like teeth, usually four on each side, in each jaw. First dorsal of three spines, the anterior of which is much the largest (the third rarely minute or obsolete); second dorsal and anal rather long, similar to each other, often falcate or filamentous in front; caudal fin usually rounded, with the outer rays produced; pelvic bone very long, with a blunt, usually movable spine at its end; no barbels; branchiostegals 6; vertebre 7 + 10. Species very numerous in the tropical seas. ( $\beta \tilde{\omega} \lambda \tilde{\omega}$ , to shoot.)

- a. Caudal pedincle compressed; teeth white, uneven, more or less notched; cheeks without naked stripes; larger bony plates behind gill-opening.
  - b. A groove in front of the eye; tail without spines or tubercles. (Balistes.)

#### 1318. B. vetulus L.

Two curved, bluish, dark-edged bands on the side of the head, the lower from the angle of the mouth towards the throat, the upper from above the snout to the root of the pectoral; a black light-edged line, similarly curved below the eye; several other similar lines radiating from the eye; caudal fin margined above and below with bluish, and with an intra-marginal bluish band; dorsal and anal fins with transverse bluish bands; young with some irregular oblique black lines following the rows of scales. Scales on head much smaller and more crowded than those on body; third dorsal spine shorter and weaker than second; caudal fin widely forked, the lobes filamentons and about equal. Head 3; depth 1½. D. III-29; A. 27; Lat. l. 63. Tropical parts of the Atlantic; occasional on our coast.

(Linn. Syst. Nat.; Günther, viii, 215.)

### 1319. B. capriscus Gmelin.—Leather-jacket.

Uniform brownish; second dorsal and anal chequered or marked with interrupted longitudinal brown lines; caudal mottled; young with numerous small dark-brown dots. Third dorsal spine shorter but stouter than the second; plates on head similar to those on the body; caudal lobes produced in the adult; soft dorsal high, its longest rays 14 in head. Head 34; depth 13. D. 111-27; A. 25; Lat. l. 51 to 57 (62 in specimens from Italy); about 35 scales in an oblique series from vent upward and forward. Warm seas; occasional northward; common on our Gulf coast and in the Mediterranean.

(Gmelin, Syst. Nat. i, 1471, 1788; Günther, viii, 217: Balistes fuliginosus Dekay, New York Fauna, Fish. 1842, 339.)

## **1320. B. poweli** Cope.

Ashy above, pale below; sides everywhere with series of longitudinally oval azure spots; dorsal and anal fins marked with smaller blue

spots. Form elevated, profile convex; scales without prominent spines; two or three scapular plates; first dorsal spine rugose,  $1\frac{1}{4}$  in muzzle; third dorsal spine well developed. Head  $3\frac{1}{2}$  in total length; depth  $1\frac{3}{4}$ ; D. III-26; A. 22. (*Cope.*) Newport, Rhode Island; a doubtful species (probably strayed from the West Indies).

(Cope, Proc. Acad. Nat. Sci. Phila. 1870, 120.)

#### 478.-MONACANTHUS Cuvier.

(Cuvier, Règne Animal, ii, 1817: type Monacanthus chinensis Cuvier.)

Body short and deep, very strongly compressed, covered with minute, rough scales. Mouth very small; upper jaw with a double series of incisor-like teeth, usually six in the outer and four in the inner series; lower jaw with about six incisors in a single series; teeth connivent, unequal; gill-opening a small slit, shorter than the eye, nearly vertical, below the posterior part of the eye, and just in front of upper edge of pectoral. Dorsal spine large or small; second dorsal and anal fins similar to each other, of about 30 rays each; caudal fin moderate, rounded; pelvic bone with a blunt spine; the bone connected by a movable flap of varying size; side of tail often with a patch of spines, especially in the males; no barbel. Vertebræ 7 + 11 to 14. Species very numerous in warm seas. ( $\mu o \nu o \varepsilon$ , one;  $\check{\alpha} z a \nu \theta a$ , spine.)

- a. Ventral spine movable; dorsal spine with retrorse barbs.
  - b. Abdominal flap greatly developed, extending beyond the ventral spine.

    (Monaganthus.)

### 1321. M. occidentalis Günther.

Brownish, mottled with lighter; a broad brown band across the middle of the ventral flap. Scales very small, without median crest. Spines becoming longer on caudal peduncle, which has in addition 2 or 3 pairs of strong spines curved forward, these prominent only in adults; ventral flap longer than head, about  $\frac{1}{3}$  length of body. Scales on ventral flap developed as flat plates, with their free margins pectinate. Snout pointed, the upper profile concave. Dorsal spine strong, nearly as long as head, armed behind with 2 rows of retrorse barbs; ventral spine small, rough. Head  $3\frac{1}{2}$ ; depth  $1\frac{1}{2}$ . D. I-30; A. 30. West Indies; occasional on our southern coasts.

(Günther, viii, 237.)

bb. Abdominal flap moderate, not extending beyond the pelvic spine. (Stephanolepis\* Gill.)

## 1322. M. broccus (Mitch.) Dek.—Fool-fish; File-fish.

Dull-greenish, mottled with darker; fins olivaceous, somewhat

<sup>\*</sup> Gill, Proc. Acad. Nat. Sci. Phila. 1861, 78: type Monacanthus setifer Bennett. ( $\delta r \dot{\eta} \varphi \delta v o \delta$ , crown;  $\lambda \epsilon \pi i \delta$ , scale.)

blotched. Body rather deep. Jaws subequal; eyes large, more than  $\frac{1}{3}$  length of snout. Gill-opening about as long as eye, separated from the eye by an interspace nearly equal to its length. Anterior profile slightly concave. Dorsal spine somewhat shorter than snout, inserted above posterior part of eye, stout, rough, armed behind with 2 rows of retrorse barbs. First ray of soft dorsal said to be sometimes filamentous (not so in our specimens); pectorals small. Pelvic bone long, ending in a short, blunt, movable spine, beyond which the abdominal flap does not extend; length of free edge of flap when expanded not greater than diameter of eye. Scales minute, each with a crest of about 3 prickles, those on caudal peduncle villous, those on the ventral flap larger, elongate; no naked areas; no recurved spines on tail. Head  $3\frac{1}{2}$ ; depth  $1\frac{3}{4}$ . D. I=32; A. 32. L. 6 inches. Cape Cod to Tropical Seas; abundant on our South Atlantic coast.

(Balistes broccus Mitch. Trans. Lit. & Phil. Soc. i, 467, 1815: Monacauthus broccus, massachusettensis, and setifer Dek. N. Y. Fanna, Fish. 1842, 335-337: Monacauthus massachusettensis Storer, Fish. Mass. 425: Monacauthus setifer (in part) Günther, viii, 240: Stephanolepis setifer Gill.)

## 1323. M. davidsoni Cope.

Brown, with 5 longitudinal bands with pale centres, the upper and lower forming 3 dark blotches at the base of dorsal and anal; head unspotted; candal with a brown cross-band. Scales with 3 sentes on a common base; longer, slender, recurved spines on tail, in 2 clusters of 3 each; sides with slender scattered filaments. Dorsal spine with strong teeth, its height one-half depth of body. Pelvie plate elongate, spinous all around. Depth  $2\frac{1}{5}$ . D. I=30; A. 28. Florida Reef. (Cope.)

(Cope, Trans. Amer. Phil. Soc. Phila. xiv, 476, 1870.)

## 1324. M. spilonotus Cope.

Light-brown; some longitudinal lines just below the dorsal fin, the median developing a dark spot below the middle of the soft dorsal. Scales each supporting a pedicle, whose summit divides into 4 or 5 radiating spines. Body elongate; outline of front straight. Dorsal spine long, with simple teeth,  $4\frac{1}{4}$  in length of body; dorsal and anal fins medially elevated; no brush or spines on candal peduncle. Pelvic shield elongate, spinous all around, the movable portion present. Depth  $2\frac{1}{2}$ ; D. I-32; A. 31. Gulf of Mexico. (Cope.)

(Cope, Trans. Amer. Phil. Soc. Phila. xiv, 476, 1870.)

aa. Ventral spine fixed; dorsal spine weak, without barbs; abdominal flap moderate. (Cantherines\* Swainson.)

### 1325. M. pullus Ranz.

Coloration variable, generally with a whitish spot behind the last dorsal ray. Body moderately elevated. Snout moderately produced, with the upper profile slightly concave. Posterior margin of eye directly above axil. Adults with two pairs of strong recurved spines on each side of tail; eaudal short. Dorsal spine nearly straight, rather shorter than head, without barbs, situated above the front of eye. Skin with a velvety appearance; the scales minute. Depth about 2. D. I–35; A. 31. (Günther.) Tropical Seas, north to Southern Florida.

(Ranzani, Nov. Comm. Act. Sci. Inst. Bonon. v, 4, 1842: ? Monacanthus pardalis Rüppell, N. W. Fish. 1855, 57: Monacanthus pardalis Günther, viii, 230.)

#### 479.-ALUTERA Cuvier.

## File-fishes.

(Cuvier, Règne Anim. ed. 2, ii, 829, 1829: type Balistes monoccros Osbeck.)

Body oblong or rather elongate, strongly compressed, covered with minute, rough scales. Mouth and teeth essentially as in *Monacanthus*, but the lower jaw more projecting, so that the lower teeth are directed obliquely upward and backward. Gill-opening an oblique slit, longer than eye, situated below and in advance of eye, its posterior end behind base of pectorals. Pelvic bone long, falcate, movable under the skin, without spine at its extremity. Dorsal spine small, inserted over the eye, rough, but without barbs; soft dorsal and anal long, each of 36–50 rays; caudal fin convex; pectorals small. Species numerous. (? ἀλουστος, unwashed.)

## 1326. A. schæpfii (Walb.) Goode.

Dull-greenish, marbled with lighter and darker; lower lip dusky. Eye small, about 4 in snout. Gill-slit nearly twice as long as eye, its upper posterior edge nearly under the middle of the eye. Pectoral fins scarcely half longer than eye. Dorsal spine slender; dorsal and anal fins low; caudal very long in the young, becoming shorter in the adult. Scales minute, shagreen-like, uniform over the body. Head  $3\frac{1}{3}$  in length; depth  $2\frac{1}{3}$ . D. 1–36; A. 38. L. 16 inches. Cape Cod to West Indies; abundant southward.

(Balistes schopfi Walbaum, Artedi, Pisc. 1792, 461: Balistes aurantiacus Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 468, 1815 (adnlt): Alutera cuspicauda Dekay, New York Fauna, Fish. 1842, 338 (young): Ceratacauthus aurantiacus Gill (adnlt).)

<sup>\*</sup> Swainson, Class. Fish. etc. ii, 327, 1839: type Cantherines nasutus Swainson: Balistes sandwichensis Q. & G. (πανθος, ass; ρίν, snout.) (=Liomonacanthus etc. Bleeker.)

## 1327. A. scripta (Osbeck) Bleeker.

Head and body with irregular blue spots and lines, and small, round black spots. Skin finely velvety. Body oblong, its depth equal to distance from snout to posterior margin of orbit. Snout produced, the upper profile concave. Dorsal spine very feeble, above middle of orbit. Part of gill-opening in advance of orbit. Pectoral fin inserted below orbit; caudal elongate, about as long as head; dorsal and anal low. Depth 3. D. 46; A. 50. (Günther.) Tropical seas; occasionally north to South Carolina.

(Balistes scriptus Osbeck, Itin. i, 144, 1771: Monacanthus scriptus Günther, viii, 252.)

# FAMILY CXXIX.—TETRODONTIDÆ.

(The Puffers.)

Body oblong or elongate, usually little compressed, and sometimes very broad; belly capable of great inflation; skin scaleless, usually more or less prickly, sometimes with strong spines. Teeth in each jaw wholly confluent, forming a sort of beak which in each jaw is sometimes divided by a median suture; lips full; nostrils various. Fins of soft rays only; dorsal fin posterior, opposite and similar to the anal; caudal fin distinct; no ventral fins; pectoral fin short and broad, its upper rays longest. Pelvic bone undeveloped. Gill-openings small, close in front of the pectorals; air-bladder present. Genera about 10; species 80; inhabiting warm seas; noted for their habit of filling the stomach with air. When inflated, the diameter of the belly is often greater than the length of the body.

(Gymnodontes, group Tetrodontina Günther, viii, 270-316.)

- a. Both jaws divided by a median suture. (Tetrodoutiuw.)
  - b. Nostril on each side a single tube, with two openings.
    - с. Dorsal and anal falcate, of 12 to 15 rays each........Lagocephalus, 480.
- - d. Spines very small, flexible, bristle-like, mostly two-rooted.

Trichodiodon, 482.

CHILOMYCTERUS, 484.

#### 480.—LAGOCEPHALUS Swainson.

(Gastrophysus Müller.)

(Swainson, Class. Fish. etc. 1839, 328; type Tetrodon lagocephalus L.)

Body comparatively elongate; skin smooth or variously prickly, the prickles most developed on the abdomen; abdomen capable of very

great inflation. Dorsal and anal fins rather long, falcate, of 12 to 15 rays each; caudal lunate. A single nasal tube on each side with two openings near its tip. Jaws each with median suture. Lower side of tail with a fold.  $(\lambda \alpha \gamma \sigma \varsigma, \text{ hare}; z \varsigma \psi \alpha \lambda \gamma, \text{ head, from the incisor teeth}).$ 

## 1328. L. lævigatus (Linn.) Gill.—Tambor; Smooth Puffer.

Olive green above, sides and below silvery white. Body elongate, the tail slender. Back and sides smooth; belly prickly, the spinous region oblong, extending from the throat backwards nearly to the vent and on sides nearly as high as base of pectoral fins; spines comparatively large, three-rooted, well separated and with no smaller ones intermixed. Eye large, silvery, 2 in snout,  $1\frac{1}{2}$  in the flat interorbital space. Gill-opening midway between snout and front of dorsal. Dorsal and anal fins large and falcate, the last rays rapidly shortered; height of dorsal  $1\frac{3}{4}$  in head; caudal fin lunate, the longest ray  $1\frac{1}{2}$  in head; fold of skin on sides of tail very distinct, ridge-like. Head  $3\frac{1}{4}$ . D. 14; depth  $4\frac{1}{2}$ . A. 12. Tropical seas, north to Cape Cod.

(Tetrodon lævigatus L. Syst. Nat. i, 411: Tetrodon lævigatus Günther, viii, 274.)

### 481.-TETRODON\* Linnaus.

(Tetrodon, Leisomus and Cirrhisomus Swainson: Cheilichthys Müller: Anchisomus Kaup.)
(Tetraodon Linneus, Syst. Nat.: type Tetraodon testudineus L.)

Body oblong, usually little elongate; skin variously prickly or smooth, sometimes with cirri. A single nasal tube on each side, with two openings near its tip. Dorsal and anal fins short, little falcate, of 6 to 8 rays each; caudal truncate or rounded. Jaws each with median suture. Species numerous, in warm seas.  $(\tau \varepsilon \tau \rho a, \text{ four}; \partial \partial \omega \nu, \text{ tooth.})$ 

- a. Tail without fold below.
  - b. Skin almost smooth.

#### 1329. T. politus Girard.

Brown, with very numerous small, round, dark spots above; usually pale curved cross-bars present, in the form of concentric rings, one on middle of back in front of dorsal, inclosing a dark area, another surrounding this, the remainder appearing as bars, anteriorly running downward and backward, posteriorly downward and forward. Skin smooth; spines rudimentary or obsolete, on belly only, imbedded in

<sup>\*</sup>The earliest subdivision of the genns Tetrodon seems to be that made by Swainson in 1839. But one Linnaean species (testudineus) is retained in the genus by Swainson. The section to which it belongs contains numerous species, and may well retain the original generic name. The value of the subdivisions is doubtful, but they may be retained for the present at least.

wrinkles of the skin; no caudal fold; nasal tentacles distinctly perforate. Interorbital area flat; sides without cirri. Head 3; depth 43. D. 7; A. 6. San Diego to Panama; very common southward.

(Tetrodon politus Girard, U. S. Pac. R. R. Surv. Fish. 1858, 340: Tetrodon politus Giinther, viii, 281.)

bb. Skin prickly, more or less.

## 1330. T. testudineus L.

Dark brown above, marbled with lighter; sides to below pectoral fins yellowish brown, marked with many round dark spots; belly and fins immaculate; back, from interorbital region nearly to base of dorsal fin, axils of pectoral and belly nearly to vent covered with minute, imbedded spines. Snout, sides, and tail naked; snout rather produced, the eye being nearer the root of pectoral than tip of snout. Interorbital area generally concave; sides sometimes with cirri; length of caudal equal to its distance from dorsal. Head 3. D. 8; A. 6. West Indies; occasional on our coasts.

(Tetrodon testudineus Linn. Amen. Acad. i, 309, and Syst. Nat i, 309: Tetrodon testudineus Günther, viii, 282.)

## 1331. T. spengleri Bloch.

Dark brown above and on sides to base of pectoral fins; sides below yellowish, with a series of about twelve round dark-brown blotches about as broad as eye; belly white; caudal fin with a brown bar at its base and a broader one at its margin. A patch of minute spines from the occiput half-way to the dorsal fin; belly spinous to near the vent; head, tail, and most of sides smooth; sides usually with numerous small cirri. Snout produced, the eye nearer root of pectoral than tip of snout. Head compressed, narrow; interorbital space slightly concave, very narrow, about half as broad as eye. Head 3. D. 7; A. 6. West Indies; occasional on our coast.

(Tetrodon spengleri Bloch, Ausl. Fische. i, 135: Tetrodon spengleri Günther, viii, 284: Cirrhisomus spengleri Swainson, Class. Fish. ii, 328, 1839.)

## 1332. T. turgidus Mitch.—Puffer; Swell Toad; Blower.

Olivaceous above, marbled with black; belly light orange; sides of body and tail with narrow irregular black cross-bars; an inky blotch below and behind pectoral fin; fins plain. Body about as wide as deep when not inflated; interorbital space slightly concave; profile not very steep, depressed in front of the eyes. Caudal peduncle, lips, and bases of fins smooth; skin everywhere else rough with small three-rooted spines, which are largest on the back and belly. No cirri. Eyes

rather small. Head  $2\frac{3}{3}$ ; depth 3. D. 7; A. 6; C. 7, slightly rounded. L. 12 inches. Atlantic coast. Massachusetts to Texas; very abundant.

(Tetrodon turgidus Mitchill, Trans. Lit. & Phil. Soc. i, 473, 1815: Tetrodon turgidus Dekay, New York Fauna, Fishes, 327: Tetrodon turgidus Günther, viii, 285.)

## 1333. T. trichocephalus Cope.

Brownish above, faintly vermiculated with lighter; sides yellowish, becoming white below; fins uniform light yellow; a brown spot at base of pectoral. Profile suddenly descending from prefrontal region to premaxillary, arched from the former point backward; belly spinous to near vent; dorsal region from a little behind the nares to above the ends of the pectoral fins spinous; spines on the head long, close-set, like seal bristles; caudal fin truncate, with prominent points. Head  $3\frac{1}{2}$  in total length; eye  $3\frac{1}{2}$  in length of head. D. 8; A. 7. (Cope.) Newport, Rhode Island.

(Tetruodon trichocephalus Cope, Proc. Ac. Nat. Sci. Phila, 1870, 120.)

#### 482.—TRICHODIODON Bleeker.

Hairy Box-fishes.

(Bleeker, Atl. Ich. Gymnodontes, 49: type Diodon pilosus Mitch.)

Body oblong, little depressed; nasal tentacle present; dermal ossifications very small, each with a pair of lateral roots, and each terminating in a fine flexible, bristle-like spine.  $(\tau \rho i \chi \ell \sigma \nu, hair; \delta \iota \delta \delta \delta \sigma \nu, Diodon.)$ 

## 1334. T. pilosus (Mitch.) Bleeker.

Brownish above, ashy below; spines of a metallic golden color; sides and back with a few oblong blackish-brown spots. Body oblong, cuboid; the skin entirely spinous, except a small space around the month and eyes and another on caudal pedancle. D. 12; A. 14. (*Dekay.*) North Atlantic; rare; said to reach a large size.

(Diodon pilosus Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 471, 1815: Diodon pilosus Dekay, New York Fauna, Fishes, 326; Günther, viii, 316.)

#### 483.-DIODON Linnæus.

Porcupine-fishes.

(Linnæus, Syst. Nat. 1758: type Diodon hystrix L.)

Body robust, the belly moderately inflatable. Dermal spines strong, stiff, most of them two-rooted and erectile, a few three-rooted and therefore immovable; both jaws entire; nasal tube simple, with two lateral openings. Pectorals broad, their margin undulate, the upper lobe longest; vertical fins rounded. Warm seas.  $(\delta\iota \xi, two; \delta\delta\omega \nu, tooth.)$ 

### 1335. D. hystrix L.

Back, sides, and fins with numerous small, round blackish spots. Spines strong, dilated at the base, with a pair of basal grooves; post-pectoral spines the longest, about as long as the pectoral fin, those of the posterior part of the back and tail short and broad, three-rooted and therefore not erectile; upper and lower part of the tail with two or three pairs of three-rooted, immovable, recumbent spines; frontal spines moderate. Head 3; depth  $3\frac{1}{2}$ . D. 13; A. 13. In all tropical seas, north to Lower California and Florida. L. about 3 feet.

(L. Syst. Nat.; Günther, viii, 306: ? Diodou spinosissimus Günther, viii, 307.)

### 1226. D. movemmencedentus Cuvier.

Olivaceous, variously spotted, usually a broad blackish brown band between orbits, extending downward behind the eye; a second parallel to it across the nape; a large transverse subtriangular spot in middle of back; a kidney-shaped spot above pectoral; all these spots usually pale edged; back and sides with small black spots. Spines varying in length; upper part of tail without ossifications, but a pair of spines lying along-side, their base on the side of the dorsal; some tentacles usually present above eye and on throat, abdomen, and back; 14 to 19 transverse series of spines between snout and dorsal. Tropical seas, north to San Diego.

("Diodon tachete" Lacépède, ii, 13: Diodon novemmaculatus, sexmaculatus, quadrimaculatus, and multimaculatus Cuyier, Mém. Mus. Hist. Nat. iv, 135, 137, 1818: Diodon maculatus Günther, viii, 307: Diodon maculatus Streets, Bull. U. S. Nat. Mus. vii, 43.)

#### 489.—CHELORENCY ERUS Bibron.

#### Rabbit-fishes.

(Bibron (Chilomyetére, Revne Zool, 1846, 140); Kaup, Wiegun Archiv, 1855, 232; type Diodon geometricus Bloch & Schu.)

Body broad, depressed, moderately inflatable. Dermal spines short, stont, immovable, triangular, each with three roots; nasal tube simple, with two lateral openings; candal peduncle short; fins small, formed as in Diodon; jaws without median suture. ( $\chi z \bar{z} \lambda o z$ , lip;  $\mu o z z / \rho$ , nose. "Narines non closes an sommet, mais chacune ayant l'apparence de deux lèvres, ou formée de deux tentacules réunis à la base.")

#### 1337. C. geometricus (Bloch & Schn.) Kaup.—Rabbit-fish; Swell Toad.

Greenish; belly pale; a round, black, occllated spot above pectorals, not as large as eye, a larger one behind pectorals, another at base of dorsal, with a smaller one below it; back and sides with parallel black stripes of uniform width about as wide as the interspaces, those on the

back running longitudinally, those on the sides obliquely downward and backward, those on the front of the head running crosswise; a dark bar at base of dorsal; other fins plain. Body a little broader than deep at the gill-openings; interocular space broad, concave; eyes large, lateral, nearly as long as snont, each with a cirrus above it, longer than the pupil; gill-opening about as wide as eye, opposite upper anterior part of pectoral. About 9 spines between eye and tail, their height equal to diameter of pupil; spines on belly much smaller, partly imbedded in skin; some of the posterior with cirri; spines on caudal peduncle; anterior root of each spine little if any larger than the others. Pectoral fin deeper than long, the margin undulate, the upper lobe longest. Head  $2_4^3$ ; depth 3. D.12; A. 10; L. 6 inches. Massachusetts to West Indies; very abundant southward.

(Diodon geometricus Bloch & Schneider, 1801, 513: Diodon maculostriatus Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 470, 1815; Günther, viii, 310.)

### Subsp. (?) fuliginosus (Dek.) Goode & Bean.

Dark brownish olive above, with wavy dusky lines; belly black, the bases of its spines bright orange. Entire body covered with large three-rooted spines, which are very numerous and close-set, especially on the belly; spines of the belly as large or even larger than those on back; not imbedded. D. 12; A. 10. Atlantic coast, from Cape Cod southward; not common; probably a young form of the preceding.

(Diodon fuliginosus Dekay, New York Fanna, Fish. 324.)

# FAMILY CXXX.—ORTHAGORISCIDÆ.

(The Head-fishes.)

Body more or less short and deep, compressed, truncate behind, so that there is no caudal peduncle. Skin rough, naked, spinous or tessellated. Mouth very small, terminal; teeth completely united in each jaw, forming a bony beak without median suture, as in *Diodon*. Dorsal and anal fins similar; posterior, more or less perfectly confluent around the tail; no spinous dorsal; no ventral fins; pelvic bone undeveloped; pectorals present. Belly not inflatable; gill-opening small, in front of pectorals; an accessory opercular gill; no air-bladder. Fishes of the open seas, apparently composed of a head to which small fins are attached. Genera 3; species 4. Found in most warm seas.

(Gymnodontes, group Molina Günther, viii, 317-320.)

- aa. Skin thick, granular or tessellated; vertical fins falcate, confluent behind. (Orthagoriscine.)
  - b. Body not twice as long as deep; skin without hexagonal plates..... Mola, 486.

#### 485 .- MOLACANTHUS Swainson.

(Pallasia Nardo: Acanthosoma Dekay.)

(Swainson, Class. Fish. etc. ii, 329, 1839: type Diodon mola Pallas = Molacanthus pallasi Sw. = Diodon nummularis Walb.)

Body suborbicular, much compressed, deeper than long, covered by a thin silvery skin on which are many strong spines. Dorsal and anal fins high and short, not confluent, the space on the tail between them occupied by a row of small spines; pectorals moderate. These small fishes have been generally considered as the young of *Mola*. The fact that they are not so was first conclusively shown by Prof. Pntnam (Am. Nat. Dec. 1870). The species inhabit the open seas. (Mola; αzάνθα, spine.)

### 1338. M. nummularis (Walb.) Gill.

Olive-brown above; sides and below iridescent silvery. Body vertically oval, higher than long; spines on body scattered, striated on sides. Head more than half length, which is little more than  $\frac{2}{3}$  depth. D. 25. (Dekay.) Atlantic Ocean; rare on our coast. L. about 2 inches.

(Diodon nummalaris Walbaum, Artedi, Pisc. 1792, 600: Acanthosoma carinatum Dekay, New York Fauna, Fish. 330: Molacanthus pallasi Putnam, 1. c.)

#### 486 .- MOLA Cuvier.

(Orthogoriscus Bloch & Schneider.)

(Cuvier, Leçons d'Anat. Comp. 1800 (fide Gill); type Orthagoriscus mola Bloch & Schneider = Mola rotunda Cuvier.)

Body ovate, strongly compressed, covered with a thick, rough, leathery, elastic skin, which is without bony plates. Profile forming a projecting fleshy nose above the mouth. Dorsal fin beginning not far behind pectorals, short and high, falcate, confluent with the anal around the tail; no large spines on the body. Clumsy fishes, found in most warm seas, reaching a great size. (Latin *mola*, a millstone.)

### 1339. M. rotunda Cuv. - Sun-fish; Head-fish; Mola.

Dark gray; sides grayish brown, with silvery reflections;, belly dusky; a broad blackish bar running along the bases of the dorsal, caudal, and.

Bull. Nat. Mus. No. 16—55

anal fins. Dorsal and anal fins high in front, rapidly decreased backwards; caudal fin low, and with a wavy outline. Depth always more than half length, and in the young the vertical diameter exceeding the longitudinal. Form varying much with age, the body becoming more elongate, the fins comparatively shorter, the eye much smaller, and a hump being developed above the mouth, topped by an osseous tubercle. Head 3; depth  $1\frac{3}{5}$ . D. 17; A. 16. Pelagic, inhabiting most temperate and tropical seas, swimming slowly about near the surface; common northward to Cape Cod and Point Concepcion. It reaches a weight of about 500 pounds.

(Tetrodon mola Linn. Syst. Nat.: Orthagoriscus mola Bloch & Schneider, 1801, 510: Orthagoriscus mola Storer, Fish. Mass. 420: Orthagoriscus analis Ayres, Proc. Cal. Acad. Nat. Sci. ii, 31, f. 54: "Mola rotunda Cuvier, 1800.")

### ADDENDA ET CORRIGENDA.

Page 3 (57). Branchiostoma lanccolatum.

To the synonymy of species No. 1, add:

("Limax lanceolatus Pallas, Spicilegia Zoöl, x, 19, about 1770.")

Until the Lancelets are more fully compared, neither our Atlantic nor our Pacific coast form can be distinguished from the European species.

Page 5. Instead of Bdellostoma read:

#### 3. Polistotrema Gill.

The generic name *Heptatrema* Duméril (Cuvier, Règne Anim.) has priority over *Bdellostoma* Müller. Species 3 may be named—

### 3. P. stouti (Lockington) J. & G.

The identity of this species, thus far known only from the coast of California from Santa Barbara northward, with the Chilian *H. dombeyi* is doubtful. The description, on page 57, is taken from California specimens. The genus *Polistotrema* Gill (Proc. U. S. Nat. Mus. 1880, 30) is distinguished by the presence of 11 to 14 gill-openings instead of 6 or 7, the base of the tongue being between the seventh and eighth (not anterior) pair of branchiæ.

Page 7. A better generic arrangement of our Lampreys than that given in the text would be as follows (omitting the character of the division of the dorsal fin, which is subject to much individual variation):

- a. Maxillary tooth single, crescent-shaped, with a cusp at each end.

6. Petromyzon; L.

<sup>\*</sup> Species E. tridentatus (Gairdn.) Gill.

<sup>\*\*</sup>Including Lampetra Gray. Species A. plumbeus (Ayres) Bean: A. aureus Bean: A. niger (Raf.) Jor.: A appendix (Dek.) J. & G.

<sup>‡</sup> Including Ichthyomyzon Grd. Species P. argenteus Kirt,: P. castaneus (Grd.) Bean: P. marinus L.: P. dorsatus Wilder.

Page 7. The genus 4 (a) Entosphenus should probably be admitted, and its species should be—

### 4. E. tridentatus (Gairdner) Gill.

It ranges from Monterey to Vancouver's Island, and Nos. "5" and "6" are not distinct from it.

On page 8, after Ammocates plumbeus, add:

### 7 (b). A. aureus Bean.

Plumbeous above, golden yellow below; under side of head and neck silvery. Maxillary tooth single, bicuspid; mandibulary with 7 cusps, the outer largest. Head shorter than chest; distance from eye to first dorsal thrice base of first dorsal; base of second dorsal twice as long as that of first, the fin twice as high; interspace between dorsals  $\frac{2}{3}$  length of head; tail (from vent) 4 in total length. Head  $10\frac{1}{3}$  ( $5\frac{1}{2}$  in distance to first dorsal). L. 15 inches. Yukon River, Alaska; abundant. (Bean.)

(Ammocaies aureus Bean, Proc. U. S. Nat. Mus. iv, 1881, 159: ? Petromyzon marinus camtschaticus Pallas, Zoogr. Rosso-Asiat. iii, 1811.)

On page 9, after Ammocates niger, add:

# 8 (b). A. appendix (Dekay) Gill.

Dusky brown, sometimes tinged with bluish; fins pale amber. A ring of irregularly-shaped corneous processes within the mouth, and a large isolated double tooth of the same texture on the inferior portion of the mouth. Origin of dorsal in advance of middle of body (behind middle in A. niger). Vent near posterior third of body. Anal papilla ("appendix") conspicuous in males in spring. Streams of New York and Southern New England. (Dekay.) Not lately recognized, but apparently differing from A. niger in the less posterior dorsal.

(Petromyzon appendix Dekay, New York Fauna, Fish. 1842, 381: Ammocates unicolor Dekay, I. c. 383; larva. Of the remaining species described by Dekay, Ammocates bicolor Le Sueur, l. c. 383, seems to be the larva of Petromyzon marinus, and P. lamotteni Le Sueur MSS. l. c. 382, is probably Petromyzon argenteus.)

Page 10. Petromyzon castaneus has been lately received from Louisiana. It is considered a valid species by Dr. Bean, as is also 9 (b), P. hirnão (Grd.) Bean. Both these species have the maxillary tooth tricuspid, not bicuspid as in P. argenteus.

Page 11. The mandibulary teeth in *Petromyzon marinus* are usually 7 in number. The plates of the anterior lingual pair are confluent, and not their serrations as stated in the text.

Page 11. Instead of P. nigricans Le Sueur, read:

### 12. P. marinus, subsp. dorsatus Wilder, sp. nov.

The "Petromyson nigricans" of the Atlantic coast streams seems to be the young of P, marinus. The Cayuga Lake Lamprey described in the text on page 11 is apparently a distinct subspecies, differing from P, marinus in the longer head (snout  $1\frac{1}{3}$  in chest; head half longer than chest; in P, marinus snout  $1\frac{3}{4}$  in chest; head one-third longer than chest); mandibulary teeth usually 8 or 9. Males with the back before dorsal fin compressed in a long, hard, fleshy ridge. Interspace between dorsals variable in length, shortest in males,  $\frac{1}{4}$  to  $\frac{2}{5}$  base of first. Tail  $3\frac{3}{4}$  in length. Coloration of P, marinus, and size not much less. Abundant in Cayuga Lake, New York; not yet observed elsewhere. The differences above noted are not very constant.

(Wilder MSS.: Petromyzon nigricans J. & G., page 11 of this work.)

Page 14. Under Echinorhiuus the reference

(Blainville, Bull. Sci. Philomath, 1816, 121)

should be supplied.

Page 18 (and 59). Instead of genus 13 (b) Scyllium Cuvier read:

#### 13 (b).—SCVLLIORHINUS Blainville.

(Blainville, Bull. Sci. Philom. 1816, 121: type Scylliorhinus catulus Blainville = Squalus canicula L.)

The generic diagnosis of "Scyllium," on page 59, applies to Scyllio-rhinus, with the exception of the clause "nostrils separated by a broad isthmus", which is true of part of the species (subgenus Catulus Smith) only. Species 18 (b) should be "S. rentriosus (Garman) J. & G."

After 18 (b), S. ventriosus, add:

### 18 (c). S. retifer (Garman) J. & G.

Light brownish, crossed at irregular intervals by groups of 2 to 4 narrow black lines, which are joined by other lines, forming a network of polygonal meshes; belly uniform yellowish. Body moderately elongate, the vent in front of its middle. Head depressed, its width nearly equal to its length in front of spiracles; length of snont from mouth less than distance between outer margins of nostrils; nasal valves broader than isthmus between them, not reaching mouth, without free cirrus; length of arch of mouth a little more than half its width; lower labial fold reaching one-fourth distance to symphysis; teeth small, each with a central cusp and two small ones on each side. Pec-

torals short and broad. First dorsal inserted near middle of length of body; caudal not large. (*Garman*.) Deep water, off the coast of Virginia; one specimen known.

(Scyllium retiferum Garman, Bull. Mus. Comp. Zoöl. xi, 233, 1881.)

Page 18. Instead of Galeorhinida, read:

# FAMILY VII.—CARCHARIIDÆ.

On page 19, instead of Mustelus hinnulus, read:

19. M. canis (Mitch.) Dek.

Add to the synonymy:

("Squalus canis Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 486, 1815: Mustelus asterias Cloquet, Dict. Sci. Nat. xiv, 407, 1820: Mustelus plebejus Bonap. Fauna Italica, 1838, 49.")

Page 20, species 20:

The Mustelus canis of our Atlantic coast seems to us to be perfectly identical with the European species, the American name having priority of date. Mustelus californicus Gill, is however a different species. It may be thus compared with M. canis, the differential characters of the latter species being interposed in parenthesis: In No. 20, M. californicus Gill, the dorsal fin is comparatively small (large), its anterior lobe obtuse, and when depressed not reaching so far as (reaching well beyond) the posterior lobe; height of anterior lobe less (more) than the base of the fin, which is little (considerably) longer than snout and less (more) than one-third the interspace between dorsals; the pectoral is comparatively short, not reaching to anterior third (reaching nearly to middle) of dorsal, or about half way to the beginning of the slit between ventrals (half way to the base of the claspers). The snout in M. californicus is more pointed, the mouth narrower, its anterior angle more acute (obtuse); breadth between angles of mouth  $\frac{2}{3}$  ( $\frac{5}{6}$ ) snout. Mustelus californicus reaches a larger size than M. canis. In Mustelus californicus the embryo is attached to the placentæ. It therefore belongs to the subgenus "Pleuracromylon" Gill.

Page 20. The genus "Rhinotriacis," introduced on page 59, may be suppressed, "R. henlei" being a species of Triacis, as given on page 20.

Page 20 (60). 20 ( $\dot{b}$ ), "Rhinotriacis lævis" (or, better, Mustelus lævis Risso) should probably be suppressed, as the evidence of its occurrence in our waters is insufficient.

## Page 21. After Galcorhinus add the reference:

(Blainville, Prodrome Faune Française, Poiss. i, 85, 1816.)

It is probable that our species is really distinct from the European. It may be characterized as—

# 23. G. zyopterus\* J. & G. sp. nov.—Oil Ehark.

Dusky gravish: most of pectoral, tip of eaudal, and anterior portion of both dorsals black. Snout depressed, rather long, but rounded at tip: nostrils considerably nearer mouth than tip of snout: the anterior lobe with a small pointed tip; interorbital space a little less than length of snout; teeth about  $\frac{3.2}{3.0}$ , the four or five teeth nearest the middle of the jaw much smaller than the others; median tooth of each jaw smallest, subtriangular, without basal cusps; lateral teeth of both jaws similar. with their points strongly directed outwards; a sharp angle near the middle of the outer margin, below which are 2 to 5 sharp cusps or serrations; labial folds moderate. Eye large, the small spiracles separated from it a distance about equal to its diameter. Head with many mucous pores. Distance between angles of mouth nearly twice length of mouth, and equal to length of snout from mouth. Pectoral fin moderate, reaching somewhat beyond front of dorsal, its tip somewhat pointed, its free edge concave. Middle of first dorsal nearly midway between pectorals and ventrals, its anterior lobe rounded, posterior, acute; second dorsal scarcely one-fourth as large as first, a trifle larger than anal, which is inserted slightly farther back.

Measurements of a large example, 63 inches in length, from San Pedro, California.

Length	100.	Length of base of first dorsal	7.3
Greatest depth	14.	Height of first dorsal	7.5
Length of head	18.	Distance between dorsals	2.5
Length of snont (from mouth)	7.5	Length of second dorsal	4.5
Length of snout (from eye)	8.	Height of second dorsal	4.
Width of month	7.	Length of anal	3,5
Length of spiracle	0.7	Length of candal	21.
Length of eye	2.5	Distance from pectorals to ventrals.	25.
Distance from snout to first dor-		Length of pectorals	15.
sal	3, 3	Length of ventrals	4.5

Coast of Southern California, from San Francisco to Cerros Island, extremely abundant. Valued for the oil in its liver, and for the fins, which are much prized by the Chinese, the gelatinous fin-rays making a fine soup.

(Galeorhinus galeus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 42, and 1881, 18: typical specimens have been distributed by the National Museum as Nos. 26927,

<sup>\*</sup> ζύος, soup; πτερον, fin.

26973, 27190, and 27391. The European species, G. galeus, is said to have the middle teeth of the jaws not reduced in size, the median tooth in each jaw with basal cusps; the second dorsal half smaller than the first; the fins plain, etc.)

Pages 22, 23, 24, 60. The groups called *Carcharinus* and *Eulamia* should rather be considered as subgeneric sections of a single genus, which may stand as—

## 18.—CARCHARIAS Rafinesque.

(Rafinesque, Indice d'Ittiol. Sicil. 1810, 44: type Squalus glaucus L.)

The species of Carcharias should stand as follows:

25. C. glaneus (L.) Cuv.

26. C. obscurus (Le Sueur) Müller & Henle.

In this species the very long pectorals extend beyond the end of the dorsal, and their outer margin is four times as long as the inner.

## 26 (b). C. platyodon (Poey) J. & G.

Slaty-blue, white below; candal blackish, other fins with dark tips. Body stout. Head very short, broad, depressed, and bluntly rounded. Mouth twice as broad as long, its breadth about half more than length of snont; inner lobe of nostril very blunt; nostril a little nearer eye than tip of snout; upper teeth very broad, triangular, erect, coarsely serrate, not notched; lower teeth narrower, more finely serrate. First dorsal beginning close behind pectoral, a little higher than long, not falcate, its base  $2\frac{1}{3}$  in interspace between dorsals; second dorsal very small, its base 5 in interspace; caudal moderate,  $2\frac{1}{3}$  in body; anal a little longer than second dorsal, and placed a little farther back; pectorals rather small, not falcate, 6 in total length, reaching a little past dorsal; width of pectoral nearly two-thirds its length. L. 10 to 15 feet. Cuba to Texas; abundant in the Gulf of Mexico; the specimen here described being from Galveston.

# 26 (c). C. plumbeus (Nardo) J. & G.

Bluish gray, whitish below. First dorsal rounded above, inserted immediately above the base of the pectoral; second near the middle of the base of the anal; pectoral one-third longer than broad, its external angle rounded. Mouth arched, its breadth equal to its distance from tip of snout; snout short, rounded, a little longer than in *C. lamia*; eyes small; upper teeth scarcely notched on the outer margin. (*Doderlein*.) Mediterranean; said to have been once taken at New York.

(Squalus plumbeus Nardo, Prodr. Ichth. Venice, 1827, 9: Carcharias (Prionodon) milbérti Valenciennes MSS. in Müller & Henle, Plag. 38, 1841: Enlamia milberti Gill, Proc. Acad. Nat. Sci. 1864, 262, in part: Carcharias milberti Doderlein, Manuale Ittiolog. Mediter. 1881, 44.)

This species should probably be omitted from our lists, as there is no good evidence that any of our sharks are identical with the *plumbeus* or the *milberti* of the Mediterranean. Probably *C. cœruleus* was originally confounded with it. The *Eulamia milberti* of recent American writers is probably the following species, which may be substituted, as—

### 27. C. cœruleus Dekay.

This species differs from C. platyodon chiefly in the following respects: Head longer, the snout much less obtuse, its length from mouth equal to breadth of mouth; distance between nostrils  $\frac{1}{3}$  less than length of snout. Teeth and fins as in C. platyodon. Pectorals rather small, not falcate,  $6\frac{1}{2}$  in body; caudal 4, rather narrow. New England to Florida; not rare.

(Carcharias caraleus Dekay, New York Fanna, Fishes, 354, 62; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882: Lamna candata Dek. l. c. 354: Enlamia milberti Gill, Proc. Acad. Nat. Sci. Phila, 1864, 262; probably not Carcharias milberti M. & H.)

### **27** (b). C. lamia Raf.

To the description on page 23 add the following:

Head broad, depressed; snout short and rounded, nostrils midway between its tip and the front of the mouth; breadth of mouth greater than preoral length of snout. First dorsal very large, commencing close behind the base of the pectoral, its height a little greater than the length of its base, its anterior margin convex, its upper angle rounded, its posterior border nearly straight, its lower angle pointed, its height about equal to greatest depth of body; second dorsal much smaller than first; pectorals at least twice as long as broad; upper lobe of caudal one-fourth the total length, twice the inferior lobe. Grayish, fins rarely darker at tip. Coasts of Europe, etc. The claim of this species to a place in our fauna is extremely questionable.

(? Carcharias lamia Rafinesque, Indice d'Ittiol. Sicil. 1810, 44, no descr.: Carcharias vulgaris Cuvier, Regne Anim. ii, 126, 1817: Carcharias lamia Risso, Hist. Nat. Eur. Mer. iii, 119, 1826: Squalis carcharias of some early authors, not of Linnaus, whose account is based chiefly on Carcharodon.)

### 27 (c). C. lamiella Jor. & Gilb.

The species described as *E. lamia* on page 60 is probably distinct from the European species, and has been described by us (Proc. U. S. Nat. Mus. 1882) as *Carcharias lamiella*. In this description, on page 61, tenth line, for *height* read *size*. In the thirteenth line, read "in *not* having the first dorsal higher", etc.

Page 24. Instead of Aprionodon punctatus read:

## 29. A. isodon (Müll. & Henle) Gill.

It is doubtful whether this species has ever been taken on our coasts. The name *punctatus* is very doubtfully applied to this species, as the *Squalus punctatus* of Mitchill is as likely to have been *C. terrænovæ*. *A. isodon* should be suppressed from our lists until its alleged occurrence in our waters is verified.

On page 25, the genus *Reniceps* is probably unworthy of retention, and it should be reunited to *Sphyrna*. The characters to be assigned to the genus *Sphyrna* are included under the account of the family. Species 31 should be—

### S. tiburo (L.) Raf.

The correct reference to the description of *Sphyrna* is—(Rafinesque, Indice d'Ittiol. Sicil. 1810, 46.)

On page 27, family X should be *Odontaspididæ*. Its single genus may stand as—

#### 25.—ODONTASPIS Agassiz.

(Agassiz, Poissons Fossiles, iri, 87, 1836; type Squalus ferox Risso.)

The American species should stand as—

#### 31. O. littoralis (Mitch.) J. & G.

The prior name americanus (Mitch.) was the result of an error of identification.

Page 28. Instead of *Isurus glaucus* read:

#### 35. I. dekayi (Gill) J. & G.

Dark bluish-gray above, white below, the color abruptly changing on the tail; upper fins dusky, lower pale. Head 5 in length to tip of caudal; pectoral as long as head, a little longer than upper caudal lobe. Dorsals and pectorals falcate; first dorsal inserted behind pectoral at a distance equal to one-fourth head; base of dorsal  $2\frac{1}{3}$  in head, its height  $1\frac{3}{4}$ . Middle teeth very long, much longer and narrower than lateral teeth. Length 10 feet. Cape Cod to West Indies. The American species seems to differ from the Asiatic *I. glaucus* in its longer pectorals and higher dorsal.

(Lamna punctata Dekay, New York Fauna, Fishes, 1842, 352 (not Squalus punctatus Mitch.): Isuropsis dekayi Gill, Am. Lyc. N. Y. 1858, 153: Isuropsis glaucus Poey, Synops. Pisc. Cubens, not Oxyrhina glauca M. & H.?)

Page 29. Instead of Isurus oxyrhynchus read:

### 36. I. spallanzanii Raf.

This species should be erased, as there is no evidence of its occurrence

in our waters. "Lamna punctata" Storer is doubtless based on Lamna cornubica, with which species Rafinesque's description of Isurus oxyrhynchus is identified by Doderlein. This species should probably stand as I. spallanzanii Raf. (Indice d'Ittiol. Sicil. 45, 1810).

Page 30. The reference to the generic description of Carcharodon should be—

(Smith MSS.; Bonaparte, Mem. Soc. Neufeh. ii, 9, 1839: type Carchardon smithii Bon. = C. carcharias.)

Page 30. Instead of C. rondeletii read:

### 38. C. carcharias (L.) J. & G.

To its synonymy add:

(Squalus carcharias L. Syst. Nat. i, 400, excl. syn. pars: Carcharias verus Agassiz, Poiss. Foss. iii, 91, 1836.)

Page 31. The reference to *Cetorhinus* should be—
("Blainville, Bull, Soc. Philom. 1816, 121.")

No. 39 should be—

#### 39. C. maximus (Gunner) Blainv.

and to the synonymy should be added:

(Squalus maximus Gunner, Trondj. Selskschr. iii, 33, 1765.)

Page 31. The family *Rhinodontidw* and its species, *Micristodus punctutus*, should be omitted, as they do not belong within our faunal limits.

Page 32. Instead of 31, Gyropleurodus, read:

#### 31.—HETERODONTUS Blainville.

(Blainville, Nonv. Bull. Scienc. 1816, 121: type Squalus phillipi Lac.)

The characters of the genns are equivalent to those of the family. The American species should stand as—

### 41. II. francisci (Grd.) Gill.

It is abundant on the coast of California from Point Concepcion southward.

On page 37, instead of *Pristis antiquorum*, read:

#### 41. P. pectinatus Latham.

And read in the description, "rostral teeth in 25 to 28 pairs" (instead of 16 to 20, the number found in *P. antiquorum*; we find no authentic record of the occurrence of the latter species in our waters). *P. pectinatus* occurs in the Tropical Seas, north to our South Atlantic coast; abundant in the Gulf of Mexico; ascending the Lower Mississippi.

(Latham, Trans. Linn. Soc. ii, 298, 1794; Günther. viii, 437.)

On page 37. The *Rhinobatida* are all ovoviviparous, a character which distinguishes them from the oviparous *Raiida*.

On page 38. Rhinohatus leucorhunchus Günther is not identical with R. nroductus, and should be erased from the synonymy of the latter species, which does not extend southward from California. In R. productus the rostral ridges are armed with small spines above, and are largely confluent anteriorly, not "separated along their entire length," as stated in the text; anterior nasal valve not dilated laterally and not extending to the inner edge of the nostril; first dorsal well behind tips of ventrals, not reaching nearly to the second. Females with a small digitate flap, free behind, above tip of snout. Color gravish, without pale spots; snout paler, a black blotch beneath it. San Francisco to San Diego. The description quoted in the text, from Dr. Streets, was taken from a specimen of R, leucorhynchus, R, productus and R. lentiginosus belong to the subgenus Rhinobatus, distinguished from "Syrrhina" by the long, sharp shout and narrow hasal flaps. Our two species of "Syrrhina" have each recently been made the types of new generic names, viz: "Zapteryx" (Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 53: type Platyrhina exasperata J. & G.) and "Platyrhinoidis" (Garman, Proc. U. S. Nat. Mns. 1880, 522: type Platyrhina triseriata J. & G.). Platyrhinoidis is "distinguished from Syrrhina and Tryonorhina by the labial fold, nasal valves, and marginal series of spines, and from Platyrhina by the fold, valves, separation of pectorals, and viviparity." Trygonorhina alventa Garman, Bull. Mus. Comp. Zool. 1880, 169, is identical with Rhinobatus exasperatus.

In *R. exasperatus* the dorsals are well forward, the origin of first dorsal being nearer hinder part of root of ventrals than front of second dorsal. In *R. triseriatus* the origin of first dorsal is nearer root of caudal than the hinder part of root of ventrals. In the latter the rostral ridges are strongly convergent, in *R. exasperatus* they are parallel.

On page 39, add to description of 47, Torpedo californica Ayres:

Color very dark brown, with small round black spots, which are sometimes obsolete. Eyes small, the spiracles at a distance behind them more than twice diameter of eye and more than length of spiracle; edges of spiracles not fringed; breadth of month about equal to its distance from tip of snout. Teeth small, sharp, in few series. Tail a little shorter than disk. First dorsal fin more than twice as large as second; half of it opposed to the ventrals. Coast of California; thus far seen only about San Francisco and Santa Cruz.

On page 39, after description of Torpedo ealifornica, add:

### 36 (b).—NARCINE Henle.

(Henle, Ueber Nareine, 31: type Torpedo brasiliensis Olfers.)

Disk more or less rounded, not emarginate in front; spiracles extremely close to the eyes, their edges tuberculate or smooth; mouth narrow, surrounded by a circular fold of skin, which forms the frenum of the nasal valve; teeth in quincunx, not occupying the whole of the jaw, following the edge of the jaw outward, so that most of them are visible when the mouth is closed. Tail about as long as disk. Second dorsal larger than first. Tropical Seas. (νάρχη, numbness, an ancient name of the Torpedo.)

### 47 (b). N. brasiliensis (Olfers) Henle.

Subsp. corallina Garman.

Orange; a dark brown band across the head in front of the eyes, interrupted on the forehead; a large triangular space of the light color on the snout in front of the dark band; rest of body with faint dark markings and small round spots. Posterior borders of dorsals and caudal truncate; otherwise as in N. brasiliensis (Olfers) Henle, of which species this is thought to be a local variety. (Garman.) N. brasiliensis has the disk oval; the first dorsal smaller than the second; the teeth pointed and the spiracles very close to the eye, surrounded by a ring of small tubercles. Pensacola, Florida, to Brazil.

(Torpedo brasiliensis Olfers, Torped. 19: Günther, viii, 453; Garman, Bull. Mus. Comp. Zool. xi, 234, 1881.)

On page 42, after Raia granulata, add:

#### 53 (b). R. ormata Garman.

Allied to R. eglanteria. Light brownish, freckled with paler, marked with a few groups of small darker spots; several spots on the tail; one at base of each dorsal. Disk little broader than long, the anterior margins convex; tip of snout obtuse; snout not produced; rostral cartilage obtuse. Width of mouth three-fourths its distance from end of snout. Teeth in upper jaw in 44 series. A median series of spines on back and tail; a lateral series on each side of this on back, and two on tail; a series on each orbital ridge; a single spine on forchead between eyes; several above tip of snout; a group on hinder angle of pectoral and on its anterior extremity; besides these the entire upper surface is rough with small asperities; lower surface smooth. Tail a little longer than disk. Deep water; off the coasts of South Carolina and Florida. (Gar-

man.) Perhaps a local variety of R. ackleyi Garman, a species described from Yucatan Banks.

(Garman, Bull. Mus. Comp. Zool. xi, 235, 1881.)

### 53 (c). R. plutonia Garman.

Brown, the adults purplish, with irregular transverse series of ill-defined, often confluent brown spots, besides some white spots; tail with light and dark bands; dorsals dark; lower surface white. Disk broader than long, subquadrangular, rounded in front; snont forming a very blunt angle; tail half longer than disk; rostral cartilage short, not extending to the tip of the snont. Width of mouth half its distance from snont. Teeth in 32 series. Eyes large, their length more than interorbital width. Back and tail covered with small, close-set, stellate spines, the points slender, compressed, directed backwards. A close series of large spines along the middle line of back and tail; a supra-orbital row, and a single spine on each side of back of head; a series of about five on each side of shoulder-girdle, in front of which are one or two more; two series on each side of tail. Lower parts smooth. Deep water; off coast of South Carolina. (Garman.)

(Garman, Bull. Mus. Comp. Zool. xi, 236, 1881.)

On page 42, instead of Raia cooperi, read:

### 54. R. binoculata Grd.

The synonymy given to "R. binoculata" on page 44 should be transferred to this species, the original "binoculata" being the young, and "cooperi" the adult, of the same species.

On page 43, instead of Raia binoculata, read:

#### 56. Et. inormata Jordan & Gilbert.

For the synonymy given on page 44 substitute the following: (*Raia inormata* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 457 and 1881, 74.) Var. *inermis* is also described in *loc. cit*. 1881, 74.

On page 45, after Raia stellulata, add:

#### 57 (b). R. parmifera Bean.

Olive brown above, with numerous faint light blotches, two of which are larger than the rest. Disk considerably broader than long; tip of snout slightly projecting; interorbital width 3½ in distance from snout to eye; tail as long as distance from its root to eye. Teeth in 27 rows. Snout, supraoccipital region, and whole margin of pectorals and ventrals, covered with small prickles, as is also an area on tail; back and

tail with a median row of 22 to 29 large spines; tail with a marginal row of large spines; rest of disk mostly smooth. Lower surface smooth, except an elliptical area below tip of snout. L. 3 feet. Unalashka, Alaska. (Bean.)

(Bean, Proc. U. S. Nat. Mus. iv, 157, 1881.)

On pages 47 and 65, instead of "Dasyatis Rafinesque" or "Dasibatis Walbaum," read:

#### 40.-TRYGON Adanson.

(Adanson MSS.; Geoffroy St. Hilaire, Deser. Egypte Poiss. 1809, 219: type Trygon lymma St. Hil. = Raia pastinaca L.)

The name Trygon seems to be prior to Dasyatis Raf. (1810); the earlier Dasybatus of Walbaum included all the rays, and is therefore properly a synonym of Raia L. The name Trygon is from τρογών, a turtle-dove. "Ab alarum erpansarum similitudine. Sunt qui columbam marinam appellant" (Rondelet, de Piscibus, 332, 1554).

The North American species of Trygon should stand as follows:

- 61. T. centrura (Mitch.) Linsley.
- · 61 (b). T. hastata (Dekay) Storer.
  - 62. T. savi (Le Sueur) M. & H.

The specimen described on page 48 as "Dasyatis sayi" is the young of T. sabina.

- 63. T. dipterura Jor. & Gilb.
- 64. T. tuberculata (Lac.) Dum.
- 65. T. sabina Le S.

Page 50. Instead of Aëtobatis read:

#### 41.-STOASODON Cantor.

(Aëtobatis Müller & Henle, Plagiostomen, 1841, 179: not of Blainville, Bull. Soc. Philom. 1816, 112 (= Myliobatis): Stoasodon Cantor, Catalogue Malayan Fishes, 1850, 1416: type Raia nurinari Euphr.)

As the type of Aëtobatis Blainv. was Raia aquila L., the use of the same name for a different genus is not allowable. (στοᾶς, arch; δδοδς, tooth.) Our species should stand as—

66. S. narinari (Euphrasen) Cantor.

Stoasodon laticeps (Gill) J. & G. (Aëtobatis laticeps Gill, Ann. Lyc. Nat. Hist. N. Y. 1865, 137 = Aëtobatis latirostris Günther, Fish. Centr.

Amer. 1869, 491), described from a specimen sent from San Francisco, should probably not be included in this work. The species is abundant on the west coast of Mexico, from which region the typical specimen was most likely obtained.

Page 50. An earlier reference to *Myliobatis* is— (Duméril MSS.; Geoffr. St. Hilaire, Descr. Poiss. Egypte, 1809, 336.)

Page 53. To synonymy of "Manta birostris" add: (Raia birostris Walbaum, Artedi Pisc. 1792, 535.)

On page 77, last line, and page 78, forty-fourth line, for *Pristipomatidæ*, 87, read: SPARIDÆ, 88.

On page 78, seventh line, for Teuthydida, read: ACANTHURIDÆ, 99.

On page 78, thirtieth line, for Trachinida, read: LATILIDA, 102.

On page 78, nineteenth line, for Centrarchidw, 84, read: Elassomatidæ, 83 (b).

On page 79, seventeenth and twenty-ninth lines, for *Triglida*, 108, read: AGONID.E, 108 (a).

On page 80, twenty-first line, for Trachinidx, read: TRICHODONTIDÆ, 102 (b.)

On page 80, thirty-fourth line, for "B," read "A A."

On page 81, after YYY, add:

YYYY. Dorsal fin single, the anterior half spinous, the posterior soft.

Blennidæ, 112.

Page 92. The group here called *Litholepis* is to be considered as a section of *Lepidosteus* rather than as a distinct genus. The name *Atractosteus* (Raf. Ichth. Oh. 1820, 73) should probably be adopted instead of *Litholepis*. The name *Litholepis adamantinus* was given to a drawing by Mr. Audubon. A copy of this drawing was preserved by Rafinesque in his field-note book, which we have examined. It is evidently a fancy sketch, like the "*Pogostoma*," "*Aplocentrus*," "*Eurystomus*," and other ichthyological myths, which the humorous artist imposed on the credulous naturalist. *Esox viridis* L. was undoubtedly intended for *Lepidosteus osseus*.

Page 101. Instead of Pilodictis read:

### 53.-LEPTOPS Rafinesque.

(Ratinesque, Ichth. Oh. 1820, 64: type Pimelodus viscosus Raf. = Silurus olivaris Raf. λεπτός, small: ώψ, eye.)

The species should stand as-

### 91. L. olivaris (Raf.) J. & G.

"Pilodictis limosus" Raf. was likewise based on a "drawing by Mr. Audubon," which drawing, as shown by Rafinesque's copy, is merely a fancy sketch of an imaginary cat-fish. The name should therefore be disregarded. Of the remaining synonyms of this type, Leptops stands next in date.

On page 105, after Amiurus catus, add:

### 98 (b). A. brachyacanthus Cope.

Blackish, yellowish below. Body robust. Head not depressed; eye small, 7 in head, 4 in interorbital width. Maxillary barbels reaching middle of pectoral spine; mental barbels to beyond the branchiostegals; jaws equal. Dorsal and pectoral spines small, acute, not concealed in the skin, equal in length, less than the interorbital width, and not one-third distance from snout to dorsal; pectoral spine weakly serrate behind only; caudal not described. Head  $3\frac{\pi}{5}$ ; depth  $4\frac{\pi}{5}$ . D. I, 6; A. 22; P. I, 6. Medina River, Texas. (Cope.)

(Cope, Bull. U. S. Nat. Mns. xx, 35, 1880.)

On page 105, after Amiurus natalis, add:

#### 100 (b). A. bolli Cope.

Olivaceons, belly and lower barbels pale. Body very slender. Head flat, one-fifth longer than wide; jaws subequal; base of anal as long as head. Pectoral spine finely serrate posteriorly, more than half length of head; dorsal spine long, smooth, a little shorter than pectoral, its base a little nearer muzzle than adipose fin; longest anal rays half head; caudal rounded, its upper rays longer than lower. Head  $3\frac{2}{3}$ ; depth  $5\frac{1}{4}$ . A. 25. Little Wichita River, Texas. (Cope.) Perhaps a variety of A. natalis.

(Cope, Bull. U. S. Nat. Mus. xx, 35, 1880.)

Page 106. The genus *Ictalurus* has been heretofore usually distinguished from *Amiurus* by the connection of the supraoccipital process with the second interspinal. In all the species with truncate or rounded caudal fin, there is a considerable interval between these bones. In the

Bull, Nat. Mus. No. 16——56

fork-tailed species, commonly referred to Amiurus, the two bones are more or less close together; in some species apparently joined in the young, but separated in the adult; in others apparently slightly separated at the surface and joined under the skin. In but two species, furcatus and punctatus, is there a continuous bridge formed at all ages. In view of the complete intergradation of this character, we have retained the name Amiurus for the species with truncate caudal and the interspinal and supraoccipital wholly separate, and Ictalurus for those with forked caudal and the two bones in question joined or approximated. The only other alternative, and a not unreasonable one, is to refer all these species to one genus, Ictalurus.

On page 108, instead of Ictalurus lacustris, read:

106. I. migricans (Le S.) Jor.

The "Gadus lacustris"\* (Walb. Artedi, Pisc. 1792, 144) can hardly be identified with any fish.

Page 110. To the description of Arius felis, the following may be added:

Bands of palatine teeth large, not prolonged backward over the pterygoid region; fontanelle prolonged backward in a narrow groove; occipital process long, narrow, keeled. Pectoral rays I, 9.

Arius equestris B. & G., is not distinct from A. felis, and should be erased.

Page 111. Instead of Plectos poudyli read Order L. Eventognathl. The latter name is unobjectionable, and has priority of date.

Page 113. We do not believe that *Ictiobus*, *Bubalichthys*, and *Carpiodes* can be maintained as distinct genera, and think it preferable to unite the three under the earliest name, *Ictiobus*. In its dentition, *Ictiobus* is intermediate between *Carpiodes* and *Bubalichthys*, and in structure of mouth *Bubalichthys* stands between the others.

We have examined the original manuscript note-book of Ratinesque, containing the descriptions which were afterwards printed in the Ich-thyologia Ohiensis. In this book is a drawing of his "Ictiobus bubalus,"

<sup>\*</sup> It is described as follows:

<sup>&</sup>quot;Gadus lacustris, Americanis Mathemeg, Anglis Land Cod, Pennant, Arct. Zool. Introd. p. 191. Corpus tripedale, superne sub spadiceum, inferne griseum; cirri tres in mandibula inferiore, quorum medius longitudine duos alios vincit."

The "Mathemeg or Land Cod" of Pennant is said by Richardson to be a cat-fish, and it may have been *I. nigricans*, but the description is wholly insufficient.

from which it is evident that the species intended was the Catostomus bubalus of Kirtland—the Bubalichthys altus of this work (p. 116). If this identification be accepted in our nomenclature, the specific name bubalus should take the place of altus, and cyprinella that of bubalus. If Rafinesque's species be considered unidentifiable, the same change should be made, as Kirtland's use of the name bubalus followed next. As Rafinesque's L. bubalus was the type of his Ictiobus, in strictness the name Bubalichthys should be superseded by Ictiobus as a subgeneric name, while the group heretofore called Ictiobus would be called Sclerognathus C. & V.

In this view, the species should stand as follows:

113. I. cyprinella (C. & V.) Ag. (Sclerognathus.)

114. I. urns (Ag.) J. & G. (Ictiobus.)

115. l. bubalus Raf. (Ictiobus.)

116. I. carpio (Raf.) Nels. (Carpiodes.)

117. I. damalis\* (Grd.) J. & G. (Carpiodes.)

118. I. thompsoni (Ag.) Nels. (Carpiodes.)

119. I. bison (Ag.) Nels. (Carpioles.)

120. I. cyprinus (Le S.) J. & G. (Carpiodes.)

121. I. difformis (Cope) Nels. (Carpiodes.)

Of these species, 117, 118, 119, and 121 are of doubtful validity.

Page 126. The following species of Catostomus may be added:

130 (c). C. nebulifer Garman.

Brownish, clouded and blotched with darker; a blackish lateral shade; belly pale; lower half of preopercle abruptly silvery. Body stout, little compressed. Head nearly as broad as eye; eye small, about half snout; mouth small; lips with considerable free margin. Dorsal inserted midway between snout and caudal; caudal deeply notched; anterior rays of dorsal longest. Head 5; depth 5. D. 9; A. 8; scales 14-90-14. Nazas River, Coahuila. (Garman.) Very close to C. guzmaniensis, if not the same.

(Catostomus nebuliferus Garman, Bull. Mus. Comp. Zoöl. viii, 89, 1881.)

<sup>\*</sup>It is better not to adopt the name tumidus for any species of Carpiodes, as the original Carpiodes tumidus is not certainly identified. The description agrees well with young specimens of I. bubalus, a species lately obtained by us in Texas.

Page 145. "Teeth one-rowed (Chondrostominae)" belongs after ‡, not tt.

Page 148, thirtieth line, instead of *Alburnus*, read: RICHARDSONIUS, 108.

Page 156. Hyborhynchus flavipinnis is described by Professor Cope in Bull. U. S. Nat. Mus. xx, 36, 1881, and H. nigrotæniatus and Cochlognathus biguttatus, on page 37 of the same paper.

Page 157. After H. fluviatilis add:

### 188 (b). III. punctifer Garman.

Brownish, paler below; cheeks silvery; scales punctulate; a black spot at base of caudal. Body little compressed, the anterior profile regularly curved. Head moderately broad; snout rounded, little longer than eye; mouth small; maxillary reaching half way to eye. Ventrals short, not reaching vent, inserted a little in advance of dorsal. Pectorals short, reaching little more than half way to ventrals; caudal deeply notched. Lateral line slightly decurved. Head 4; depth 4. D. 8; A. 8; scales 5–40–3. "Distinguished from D. couchii Grd. by the size of the scales and a stouter form." Tributaries of Lago del Muerte, Coahnila. (Garman.)

(Hyboguathus (Diouda) punctifer Garman, Bull. Mus. Comp. Zoöl. viii, 89, 1881.)

Page 176. After C. bubalina add:

### 236 (b). C. rubripinna (Garm.) J. & G.

Brownish above, sides rosy or silvery; cheeks silvery; a brownish band from nape to pectorals; lower fins salmon color; candal reddish; dorsal dark brown. Body deep, much compressed, the back arched. Head small; snout shorter than eye; maxillary not reaching eye. Pectorals not reaching ventrals, the latter to anal; caudal deeply forked. Scales much deeper than long. Head  $4\frac{1}{2}$ ; depth  $2\frac{2}{3}$ . D. 8; A. 11; scales 7–38–3. L. 3 inches. Tributaries of Lago del Muerte, Coahuila. (Garman.)

(Cyprinella rubripiuna Garman, Bull. Mus. Comp. Zoöl. viii, 91, 1881.)

### Page 206. Rhinichthys Ag.:

Professor Garman gives in Science Observer (1881, vol. iii, No. 8, p. 57) a detailed account of the genus *Rhinichthys*, in which 15 species

are recognized. These are distinguished by the characters given in the following analytical key:

a. Mouth inferior, snout produced beyond it.
b. First dorsal ray midway between end of snont and base of candal.
c. Lateral line 60-64; l. trans. $10+1+9$
cc. Lateral line 70
bb. First dorsal ray midway between anterior nostril and base of caudal.
d. Lat. 1, 75-80; 1, trans. 10+1+10marmoratus.
<i>dd.</i> Lat. 1. 70; 1. trans. $10 + 1 + 10$
bbb. First dorsal ray midway between front of mouth and base of candal.
e. Lat. l. 70; l. trans. 11+1+10; snout narrowocella.
ce. Lat. l. 80; l. trans. $12+1+12$
eec. Lat. 1, 70-72; 1, trans. $12+1+13$ transmontanus.
bbbb. First dorsal midway between middle of eye and base of candal.
f. L. trans. 25
aa. Month subinferior, snont not produced.
g. First dorsal midway between nostril and base of caudal; lat. l. 80;
l. trans. $14+1+10$
gg. First dorsal midway from eye.
h. Lat. 1. 58-60; 1. trans. $9+1+7$ simus.
hh. Lat. 1. 70; 1. trans. 11 + 1 + 8obtusus.
hhh. Lat. 1. 63; l. trans. $12+1+9$ atronasus.
i. Stout, black band obsoletelunatus.
aaa. Mouth anterior.

Most of these species we are unable to recognize. They seem to us to be merely local varieties, or even individual variations, of the two or three most widely-distributed types in this genus.

k. First dorsal midway from front of eye.

The following may perhaps be inserted:

Page 207. After R. transmontanus add:

### 316 (b). R. dulcis (Grd.) Jor. & Copel.

Reddish brown, clouded with darker; lateral band very faint; a dark caudal spot. Snout blunt, projecting beyond mouth, which is small and inferior. Barbel small, sometimes absent. Ventrals reaching vent. Scales small. Head 4¼. D. 9; A. 8; scales 12–80–12. Platte Valley. (Garman.)

(Argyreus dulcis Grd. Proc. Acad. Nat. Sci. Phila. 1856. Sweetwater River; Garman, Science Observer, 1881, 59, Cheyenne: Rhinichthys occila Garman, L. c. 59, from N. E. Wyoming and Montana, has the snout narrow, the barbel conspicuous, the scales 11-70-10: Rhinichthys luteus Garman, Bull. Mus. Comp. Zoöl. 1881, 87, and Science Observer, 1881, 59, from Ogden, Utah, has the snout long, more than twice eye, the barbel small, and the scales 10-70-10: Rhinichthys marmoratus Ag.: Garman, L. c. 58, from Sault Ste. Marie, has the scales 10-78-10, and is possibly distinct from R. cataractw.)

Page 208. After Rhinichthus atronasus add:

### 318 (b). R. badius Garman.

Brownish, mottled; sides and belly silvery. Front of dorsal midway between nostril and eye. Scales 14-80-10; otherwise as in *R. obtusus*. Clinch River. (*Garman*.)

(Garman, Science Observer, 1881, 60.)

### 318 (c). R. simus Garman.

Clouded brown; a dark lateral stripe, bounded above by a silvery line. Head depressed above and in front of eyes; snout rather broad, thin, little projecting. First dorsal midway between eye and base of caudal. Head 44. D. 9; A. 8; scales 9-60-7; teeth 2, 4-4, 2. Coahnila, Mexico. (Garman.)

(Garman, Science Observer, 1881, 61.)

#### 318 (d). R. meleagris Ag.

Similar to *R. obtusus*, but with the jaws nearly equal. Head broad, narrowed anteriorly; lips small; teeth 2, 4-4, 2. Head 3<sup>4</sup>/<sub>5</sub>. D. 9; A. 7; scales 11-70-8. Western Illinois and Iowa.

(Agassiz, Am. Journ. Sci. Arts, 1854, 357; Garman, Bull. Mus. Comp. Zoöl. 1881, 86, and Science Observer, 1881, 62.)

### 318 (e). R. arenatus Garman.

Similar to R, meleagris, but with larger scales, and the teeth 1, 4-4, 1. Head  $4\frac{1}{4}$ ; depth  $5\frac{1}{2}$ . D. 8; A. 7; scales 9-64-7. Sand Hill River, Minnesota. (Garman.)

(Garman, Bull, Mus. Comp. Zoöl, 1881, 87, and Science Observer, 1881, 62.)

Page 235, tenth line, read: "nearly reaching rentrals."

Page 241. The specimens described in the text as Squalius atrarius, are the young of the species described on page 240 as Squalius rhomaleus. Siboma atraria Cope is also identical with the latter species. Whether Siboma atraria Crd. is the same is very doubtful. The following are the characters assigned to it, and may be substituted for those given in the text:

#### 397. S. atrarius (Grd.) J. & G.

Blackish above, mottled with dark; paler below. Body somewhat elongate, subfusiform; candal peduncle stout; head larger than in *S. gibbosus*; the fins lower; profile of head gently sloping forward, the suont subconical. Mouth small, the maxillary not reaching to opposite eye. Eye small,  $5\frac{1}{2}$  in head. Dorsal inserted over ventrals, nearer

base of candal than snout. Head nearly 4 (with caudal). D. 9; A. 8; scales 11–7. Teeth 4, 4–5, 2, without grinding surface properly so called. L. 7 inches. From a spring in Utah, near the desert. (*Girard*.)

(Siboma atraria Grd. Proc. Ac. Nat. Sci. Phila, 1856, 208, and U. S. Pac. R. R. Smy, x, 297; ?Siboma atraria var. longiceps Cope & Yarrow, Zoöl, Wheeler's Expl. W.100th Mer. v. 667, 1876, from Nevada; a small fish with the scales 12–56–5, the head 4, the depth 44 in length.)

Page 244. Numerous specimens of *Phoximus phlegethontis* from Provo 18 ver examined by us are full-grown at a length of barely 2 inches; the lateral line is almost wholly wanting in all.

Page 244. If the generic name *Leucos* be considered as preoccupied, this genus should stand as—

### 101.-MYLOLEUCUS Cope.

Page 262. Instead of Megalops thrissoides read:

### 136. M. atlanticus C. & V.

And crase the synonym "Clupca thrissoides Bloch & Schneider, 1801, 424," inserting instead "Megalops atlanticus C. & V. xix, 398,"

Clupea thrissoides Bloch & Schneider is based on Broussonet's description of his Clupea cyprinoides, which is the East Indian Megalops cyprinoides (Brouss.) Bleek. On our Gulf coast, Megalops atlanticus reaches a length of about 6 feet, and is known as "Grande Ecaille."

Page 265. After Clupea sugar add:

# 141 (b). C. pseudohispanica (Poey) Gthr.—Spanish Sardine.

Plain bluish, silvery or golden below. Body slender, little compressed, the belly scarcely carinated, its scates weak; mouth small, the maxillary extending a little past front of pupil, 2\frac{3}{3} in head; lower jaw and tongue with a few feeble teeth; cheeks much longer than deep, the depth below eye \frac{3}{4} eye, which is 3\frac{1}{2} in head; opercle without striæ. Gillrakers long, very slender, 30 to 40 below angle. Caudal as long as head; ventrals below middle of dorsal; peritoneum pale. Head 4\frac{1}{4}; depth 5\frac{1}{4}. D. 18; A. 17; Lat. l. about 45. L. 6\frac{1}{2} inches. Cuba to Pensacola, Florida, Closely allied to the European Sardine (Clupca pilchardus Walbaum), which is best distinguished by the strongly striate opercle.

(Sardinia pseudokispanica Pocy, Memorias Cuba, ii, 311, 1860; Günther, vii, 442.)

Page 271. After D, cepedianum add:

### 451. D. mexicanum (Gthr.) J. & G.

Silvery, a small round dark spot at the shoulder. Maxillary reaching front of eye; jaws even in front; eye as long as snout, four in head Insertion of dorsal fin median, immediately behind base of ventrals; the filament reaching end of anal fin. Scales large; nine scates behind ventrals. Head  $3\frac{1}{5}$ ; depth  $2\frac{3}{4}$ . D. 14; A. 25; Lat. l. 40; L. tr. 13. Gulf of Mexico; north to Louisiana. (Günther.)

(Chatoëssus mexicanus Günther, vii, 409, 1868.)

Page 273. After Stolephorus ringens add:

### 452 (b). S. nanus (Grd.) J. & G.

Pale, but not translucent; sides with a broad silvery shade, but without distinct stripe. Body slender, moderately compressed, the belly carinate and faintly serrate. Head compressed, conic, the snout rather pointed, bluntish at tip. Maxillary extending beyond root of mandible. Eye not very large. Teeth in both jaws. Pectorals and ventrals short. Head  $3\frac{1}{2}$ ; depth 5. A. 22. Southern California; abundant. Very likely the young of 8. ringens, from which it seems to be separated by the more compressed body. The many specimens obtained by us at San Diego were of the same size, and schools of immature anchovies, uniform in size, are rarely seen.

(Engraulis nanus Girard, U. S. Pac. R. R. Surv. x, 334, 1858.)

Page 273. After *Stolephorus hiulcus*, which is probably identical with *S. browni*, read;

# **454** (b). S. mitchilli (C. & V.) J. & G.

Very pale, translucent, the silvery lateral stripe very narrow and not well defined, scarcely wider than pupil; snout and caudal yellowish, with many dark points; middle line of back with a continuous stripe formed of dark points; dark points along base of anal and behind it. Body rather short and deep, compressed, belly slightly serrated; snout short, not longer than pupil; eye very large; maxillary extending beyond root of mandible, about to margin of opercle; both jaws with distinct teeth; cheeks broadly triangular. Anal long and high, its base  $3\frac{2}{5}$  in body; its first ray nearly under middle of dorsal. Pectorals long,  $1\frac{1}{4}$  in head. Head  $3\frac{4}{5}$ ; depth 4. D. 14; A. 26; Lat. l. about 37. L.  $2\frac{1}{2}$  inches. Atlantic coast; abundant from Cape Cod to Southern Texas.

(Engraulis mitchilli Cuv. & Val. xxi, 50 (not of Günther); Engraulis vittatus Storer, Hist. Fish. Mass. 341, pl. xxvii, f. 3 (not Clupea vittata Mitch.); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882; ? Engraulis duodecim Cope, Trans. Am. Philos. Soc. 1866, 405 (last vay of dorsal said to be in front of first of anal).

On page 276, after Alepidosaurus ferox, add:

# 458 (b). A. æsculapius Bean.

Closely related to A. ferox, differing chiefly in the much shorter pee-

torals and ventrals, the latter of 7 rays, the former of 12. Gill rakers 23 (27 in A. ferox). Eye 5 in head, the maxillary extending to beyond it. Head 6; depth 11. D. 39; A. 16; vertebræ (as in A. ferox) 50. Unalashka, Alaska. (Bean.)

(Bean, Proc. U. S. Nat. Mas. v. 1882.)

Page 281. After Synodus lucioceps add:

### 464 (b). S. intermedius (Spix) Poey.—Sand-diver.

Grayish, abruptly paler below; back and sides with eight dark cross-bands, broadest at lateral line; a jet-black blotch on upper part of shoulder-girdle, hidden by operele; membrane of maxillary black; dorsal and pectorals barred, the former in fine pattern; lower fins and lower part of head sulphur yellow. Body rather stout; head blunt, large, the snout broader than long, about equal to eye, which is 4½ in head; frontal bones little striate; interorbital space concave, 6 in head; prominent striae behind eye; jaws subequal; maxillary 1½ in head, longer than pectoral. Scales large, 4 to 6 rows on check; 3 series between adipose fin and lateral line. Dorsal high, as high as long; pectoral 2 in head; ventral 1½. Head 4; depth 8. D. 11; A. 11; scales 4–48–7. L. 15 inches. West Florida to Brazil.

(Saurus intermedius Spix, Pisc. Brazil, 81: Saurus intermedius Günther, v., 396: Saurus analis Cuv. & Val. xxii, 483; Poey, Syn. Pisc. Cub. 414.)

On page 288, twelfth line, read: Mouth generally terminal.

On page 290, all the text between the description of *Microstoma* grænlandicum and that of *Mallotus*, on page 291, should be cancelled.

On page 300, after Coregonus merki, add:

#### 493 (b) C. laurettæ Bean.

"The height of the body is greater than the length of the head and equals one-fourth of the total length without the caudal; the distance of the nape from the front margin of the jaw is contained 2½ times in its distance from the beginning of the dorsal. The diameter of the eye equals the length of the snout, and is about one-fifth that of the head. Maxillary reaching nearly to the middle of the eye, its length contained 3½ times in that of the head; the supplemental bone about half as long as the maxilla, and its greatest width equals one-third of its length. The length of the mandible equals three-sevenths of that of the head, reaching to the hind margin of the orbit. The appendage of the ventral fin is less than half as long as the fin and nearly equal in length to the 7 scales immediately over it." Eye 5 in head. Scales much smaller

than usual in *C. artedi*. D. 12; A. 11; V. 12; P. 16; Lat. l. 84 to 95. Northern Alaska; Yukon River to Point Barrow. (*Bean*.)

(Bean, Proc. U. S. Nat. Mus. iv. 1881, 156.)

Page 306. Instead of Oncorhynchus chonicha read:

### 499. O. tchawytcha (Walb.) J. & G.

The barbarous appearance of this name scarcely warrants so great a change in its orthography.

Page 320. No. 515, Salreliuus hoodii, should be erased. The specimens in the British Museum, described by Dr. Günther as Salmo hoodi (vi, 150), belong to Salrelinus namayensh. The remaining types of Richardson's original description belong to Salrelinus fontinalis.

Page 325. After Chologaster agassizi add:

### 523 (b). C. papillifer Forbes.

The specimen from Southern Illinois, described in the text from the MSS, of Professor Forbes, proves to be distinct from *C. agassizi*. Several other specimens have been since obtained. It is further distinguished from the other members of the genus by the presence of tactile papillary ridges, as in *Amblyopsis* and *Typhlichthys*. The character of "no papillary ridges", assigned in the text to *Chologaster*, should therefore be erased.

(Chologaster papilliferus Forbes, Amer. Nat. Jan. 1882, 1.)

Page 329. Cyprinodon gibbosus appears to be identical with C, raviegatus, differing possibly in slightly greater size and deeper coloration, the ante-dorsal region being, in the males, of an intense steel-blue and the lower parts largely salmon-red. Head  $3\frac{\pi}{5}$  to  $3\frac{\pi}{5}$ ; depth 2 to  $2\frac{\pi}{5}$ . D. 11; A. 10; scales 26–13.

For Cyprinodou gibbosus (B. & G.) substitute—

#### 526. C. bovinus B. & G.

A doubtful species, differing from *C. variegatus* in having the head 3 in length, the eye 4 in head, the ventrals under anterior margin of dorsal, and the fin-rays D. 9, A. 8. Leon's Spring, Texas.

(B. & G. Proc. Acad. Nat. Sci. Phila, 1853, 389, etc.)

### **526** (b). C. eximius Grd.

Differs from C, variegatus in having the head  $3\frac{1}{3}$  in length, the eye 4 in head; D. 12, A. 12. Coloration pale, the male largely golden. L.  $2\frac{1}{2}$  inches. Chihuahua Riyer.

(Girard, Proc. Acad. Nat. Sci. Phila, 1859, 158.)

Page 333. Fundulus similis is very abundant everywhere on the Gulf coast and north to South Carolina.

Page 333. Instead of Fundulus zebra read:

536. F. zebrinas J. & G. nom. sp. nov.

The name "zebra" is preoccupied in this genus.

Page 335. Omit from the synonymy of Fundulus adinia, Adinia multifasciata Grd, which is a very different species = Fundulus xenivus J. & G.

Page 336. After F, uigrofasciatus add:

### 542 (b). F. ocellaris J. & G.

dark olive, golden below; sides with 13 to 15 dark cross-bands, nearly parallel, the interior narrower than the interspaces; sides posteriorly finely speckled, with small pearly spots on both bands and interspaces; dorsal and anal margined with orange; both fins with black and pearly spots. ♀ dark olive; sides dusted with dark points; middle of sides with about 13 very narrow dark half bars; dorsal with an occilated black spot posteriorly. Head small and slender, the snout short. Body rather slender. Eye 4 in head, 1½ in interorbital width. Teeth small, the outer series somewhat enlarged. Dorsal high, in males reaching base of candal, in females much lower; anal inserted under second ray of dorsal. Oviduet not adnate to its first ray. Head 3½; depth 4. D. 11; A. 10; V. 6; P. 13; scales 35–15. L. 3 inches. Pensacola Bay, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mns. 1882.)

Page 336. After Fundulus heteroclitus add:

### **513** (b). **F. grandis** B. & G.

Very closely related to F, heteroclitus, but differing constantly in the much lower fins, the longest rays of the dorsal even in the male not more than half head, of anal  $1\frac{3}{4}$  in head; eye 4 to  $4\frac{1}{2}$  in head, slightly more than half interorbital space. Head 3 to  $3\frac{1}{5}$ ; depth  $3\frac{5}{5}$  to  $3\frac{5}{6}$ . D. 11; A. 10 or 11; scales 35 to 38–15. L. 3 to 6 inches. Gulf coast; replacing F, heteroclitus.

(B. & G. Proc. Acad. Nat. Sci. Phila, 1853, 389, etc.: Fundulus floridensis Grd. Proc. Acad. Nat. Sci. Phila, 1859, 157.)

Page 337. After Fundulus stellifer add:

xx. Body short and deep, strongly compressed; gill-membranes restricted above to region below upper edge of pectoral. (Adinia Grd.)

### **545** (b). F. xenicus J. & G.

& dark green; sides with 10 to 14 narrow, pearly bands, slightly oblique, and mostly narrower than the interspaces; a diffuse dusky blotch below and behind eye; lower jaw orange; belly yellow; dorsal and anal blackish, with many round, pale-blue spots, besides orange spots near base of fin; caudal barred, with some pale spots; ventrals dusky, tipped with yellow. Queenish, with a faint dark lateral shade and some pale cross-bands; lower fins largely yellow; upper mostly dusky. very deep, much compressed, much as in Cyprinodon; the caudal pedancle very deep; the head depressed, rapidly tapering to a sharp, conical shout; the anterior profile somewhat concave. Females and young with the back less elevated. Teeth very small, in a villiform band, those of the outer series wide-set and considerably larger. Eye large, 3 in head, 1½ in interorbital space; opercle adnate to shoulder-girdle above base of pectoral (as in Cyprinodon and Jordanella). Dorsal inserted in advance of anal, its origin midway between caudal and middle of eye, the longest rays in males reaching base of caudal,  $1\frac{2}{5}$  in head; anal lower; ventrals 13 in head. Intestinal canal as long as body. Head 3; depth 2 ( $2\frac{2}{3}$  to  $2\frac{4}{5}$  in  $\mathfrak{P}$ ). D. 9 or 10; A. 11 or 12; V. 6; P. 14; B. 5: scales 25-10. L. 2 inches. Gulf coast, West Florida to Texas; locally very abundant in shallow lagoons.

(Adima multifasciata Girard, Proc. Acad. Nat. Sci. Phila. 1859, 117; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, not Hydrargyra multifasciata Le Sueur, nor Fandulus adinia Jor. & Gilb.)

Page 340. Zygonectes atrilatus should probably be suppressed. It appears to be based on females of Gambusia patruclis.

Page 340. Instead of Zygonectes melanops read:

### 552. Z. innurus J. & G.

The known specimens of this species are from Cache River, in Southern Illinois. For the synonymy in the text substitute—

(Zygoncetes melanops Jordan, Bull. Illinois Lab. Nat. Hist. ii, 52, 1878 (net Haplochilus melanops Cope): Jor. & Gilb. Proc. U. S. Nat. Mus. 1882: Haplochilus melanops Cope and Z. melanops Hay are apparently Gambusia patruclus.)

Page 341. Zygouectes brachypterus is described by Professor Cope in Bull. U. S. Nat. Mus. xx, 34, 1880.

Page 341. After Zygoncetes dispar add:

#### 553 (b). Z. craticula Goode & Bean.

Olivaceous; sides with about 6 sharply-defined, jet-black longitudinal

stripes following the rows of scales, the stripes a little narrower than the interspaces; a large blackish blotch below eye; fins nearly plain, the upper somewhat dusky; young with faint dark bars. Body comparatively long and slender, little compressed. Candal pedancle long, rather slender. Head long, broad and depressed above. Eye large, about equal to snout,  $\frac{2}{3}$  interorbital width,  $3\frac{1}{4}$  in head. Lower jaw heavy. Teeth small, the outer scarcely enlarged. Fins all small. Head  $3\frac{2}{3}$ ; depth 5. D. 8; A. 9; scales 40–10. Indian River, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. v. 1882.)

Page 343. Lucania venusta is generally common along the Gulf coast. Color nearly plain light olive, the males with the dorsal and caudal bright yellow, the anal orange, each of these fins margined with black; dorsal with black spot at base in front, occllated with yellow. D. 11 or 12; A. 9 or 10; scales 26-8.

# Page 343. To the description of Lucania parva add:

Plain olive, edges of scales darker; front of dorsal with a dusky spot. Body comparatively deep, the back somewhat arched. Dorsal high; anal small. Head  $3\frac{1}{3}$ ; depth  $3\frac{1}{3}$ . D. 11; A. 8; scales 26–8. L.  $1\frac{1}{2}$  inches. Connecticut to Florida (*Bean*).

# Page 345. No. 562 may be redescribed as follows:

#### **562. G. patruelis** (B. & G.) Grd.

Light olive, each scale edged with darker; a very narrow dark streak along sides; top of head dusky; an obscure bluish-black bar below eye; a black blotch on each side of belly, caused by the black peritoneum showing through the skin; fins dusky; the caudal sometimes dotted. Body rather slender. Head small, very broad and much depressed; teeth in broad villiform bands; eye small,  $1\frac{3}{4}$  in interorbital width,  $3\frac{1}{3}$  to  $3\frac{1}{2}$  in head. Intestinal canal as long as body. Dorsal small, far back; distance from its insertion to caudal half that to snout; anal larger and higher than dorsal. Head 4; depth 3 to 4. D. 7; A. 8 or 9; scales 30–10. L.  $1\frac{1}{2}$  inches. Marshes and lagoons of the South Atlantic and Gulf coasts, Delaware to Mexico, mostly in brackish or fresh water; excessively common in Louisiana. Eastern specimens (var. holbrooki; Maryland to Florida) have usually the eye larger, about one-third length of head,  $1\frac{1}{2}$  in interorbital width; head  $3\frac{3}{3}$  in length.

The young are produced in early summer, when about one-third of an inch long.\*

(Heterandria patruelis B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390; Grd. U. S. Mex. Bound. Surv. Ichth. 72: Gambusia speciosa, gracilis Grd. Proc. Acad. Nat. Sci. Phila. 1859, 121: Heterandria affinis B. & G. l. c. 390: Gambusia humilis and affinis Gthr. vi. 335, 336: Heterandria holbrooki Agassiz MSS.; Girard. Proc. Acad. Nat. Sci. Phila. 1859, 61; Günther, vi. 334: Haplochilus melanops Cope, Proc. Amer. Phil. Soc. Phila. 1870, 457: Zygonectes atrilatus Jor. & Brayt. Bull. U. S. Nat. Mus. xii, 84, 1878.)

Pages 345, 346. Gambusia humilis and Gambusia affinis may be suppressed as identical with G. patruelis.

Page 346. After Gambusia nobilis add:

### 566 (h). G. senilis Grd.

Brown, sides with dark specks; vertical fins speckled. Ventrals very small, not reaching vent; anal rather large. Head 5 in total length. D. 9; A. 10. L. 2\frac{1}{2} inches. Chihuahua River.

(Girard, Proc. Acad. Nat. Sci. Phiia, 1859, 121.)

Page 347. Under Mollienesia latipinna read:

"Eye greater than snout, 2 in head,  $1\frac{3}{4}$  to 2 in interorbital width." "Candal-membrane dark orange, with black dots." "D. 14 or 15; A. 8."

Page 347. After Mollienesia latipinna add:

#### **567** (b). **M. lineolata** (Grd.) J. & G.

Color of M, latipinna, the sides with five dark half-bars. Eye small,  $3\frac{1}{3}$  to  $3\frac{1}{2}$  in head. Dorsal fin rather small, its rays 13 (rarely 14) in number; otherwise essentially as in M, latipinna, of which it may be a variety. Marshes and lagoous of Louisiana and Texas.

(Pocilia lincolata Grd. U. S. Mex. Bound. Surv. Ichth. 1859, 70: Limia pociloides Grd. l. c. 70.)

Page 352. Instead of Esox salmoneus read:

#### 574. E. mmbrosus Kirt.

The *Esox vittatus* and *E. salmoneus* appear, from Rafinesque's manuscript notes, to have been mythical.

Page 355. Instead of *Murana melanotis*, which is not yet known to occur in our waters, substitute:

#### 578. M. retifera Goode & Bean MSS.

Body moderately stout, somewhat compressed. Teeth of upper jaw

\*Among the genera of *Cyprinodouts*, only those which have the anal fin in the male modified are *known* to be viviparous. The others (*Cyprinodon*, *Fundulus*, *Zygonectes*, etc.) are probably all oviparous.

in two series, the outer series of a few short, fixed teeth; the inner series of about 10 long, compressed teeth, a few of which are depressible, all more or less directed backward; those of the middle of the jaw somewhat larger than those in front. Vomer with 1 or 2 depressible canines. Teeth of lower jaw similar to those of upper; the large teeth rather shorter and broader; teeth all entire; mouth not closing completely. The tubes of anterior and posterior nostrils about equal. slightly shorter than eye. Cleft of the mouth 23 times in length of head; eye over middle of cleft, 13 in snont. Snout 6 in head. 23 in trunk. Tail very little longer than rest of body. Dorsal moderate, beginning over the middle of head. Gill-opening small, about as broad as eye. Color light brown, regularly reticulated with blackish, the reticulations inclosing hexagonal or roundish spots of the ground color, irregular in size, longer than the eye. Entire fish further covered thickly with small whitish spots, smaller than the pupil: these spots smallest and most numerous anteriorly, nearly obsolete on the belly, and present on the inside of the mouth. Gill-opening surrounded by a small blackish blotch not twice as broad as eye. Angle of the mouth black; dorsal with about 5 longitudinal blackish lines, which are obsolete posteriorly. Anal with a blackish longitudinal stripe. Charleston, South Carolina.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 357. After Murana ocellata add:

580 (b). M. afra (Bloch) Gthr.

Greenish black; fins with dark lines and without pale edge. Teeth uniserial in old examples, the vomerine teeth being sometimes biserial; mandible with about 20 teeth on each side, the four anterior much longer than the others, and, like the canines, rather elongate. Anterior nasal tubes half as long as eye. Gill-opening nearly as wide as eye. Snout narrow, produced, pointed; eye moderate, half length of snout, somewhat nearer angle of mouth than end of snout. Cleft of the mouth wide, two-fifths length of head. Tail longer than body. Head 2½ in trunk. Dorsal not elevated. (Günther.) Tropical parts of the Atlantic; north to Florida.

(? Gymnothorax afer Bloch, Ausl. Fische. ix, 85: Murana afra Günther, viii, 123, in part.)

580 (c). M. moringa Cuv. Moray.

Everywhere with immunerable, confluent, irregular, brownish black

spots separated by a fine network of the white ground color; each pore of the lower jaw in a round white spot; fins without white margin; in young examples the black spots are larger and fewer in number than in adults. Teeth uniserial; eanines large; jaws not shutting completely; mandible with 23 to 28 teeth on each side, of which the 3 anterior are canines, the third being separated from the preceding by an interspace. Length of anterior nasal tubes less than vertical diameter of the eye. Snout produced, narrow. Eye moderate,  $\frac{2}{5}$  length of snout, a little nearer angle of mouth than tip of the snout. Cleft of mouth very wide,  $\frac{2}{5}$  length of head. Gill-opening a little wider than eye. Tail as long as, or somewhat longer than, body. Length of head half, or a little less than half, that of trunk. (Günther.) Tropical parts of the Atlantic, north to Southern Florida.

(Cuvier, Règne Auim.; Günther, viii, 120.)

Page 358. Before Cacula insert:

# 168 (b).—LETHARCHUS Goode & Bean MSS.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882: type Letharchus relifer Goode & Bean.)

This genus differs from Cacula (Sphagebranchus) in the total absence of the anal fin. The dorsal is high and begins on the head; gill-openings subinferior, nearly longitudinal; pectoral wanting. ( $\lambda \dot{\eta} \theta a \mu a \iota$ , to forget;  $a \rho \chi \sigma \tau$ , anal.)

## 580 (b). L. velifer Goode & Bean MSS.

Body rather robust, somewhat compressed, its greatest depth a little more than \(^2\) the length of head. Head large, abruptly tapering anteriorly; snout very slender and pointed, projecting considerably beyond the lower jaw, its length  $\frac{1}{10}$  head, and nearly twice the very small eye; nasal tubes rudimentary; anterior nostril under tip of snout; cleft of mouth, from tip of shout, 4 in head; eye nearer tip of shout than angle of mouth; lower jaw short and weak; tongue short, free in front; teeth small, pointed, subequal, in narrow bands on jaws and vomer; head 63 in trunk: head and trunk 14 times length of tail. Dorsal unusually high, its height at nape equalling eleft of mouth; its insertion at first third of head. End of tail sharp. Anal fin wanting. No trace of peetorals. Gill-openings large, subinferior, oblique, convergent anteriorly, their length more than three times breadth of isthmus, and equal to lower jaw. Lateral line very distinct, extending forward in a curve to below front of dorsal. Four conspicuous pores on each side of lower jaw, 3 behind each eye, 3 at the nape in front of dorsal, 1 on top of the

head, and 4 on each side of upper part of snout, besides a few smaller ones about the lips. Dark brown, slightly mottled with darker, not paler below; head paler than body; dorsal fin pale, with a broad blackish margin. West coast of Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 358. After Cacula scuticaris add:

**581** (b). **C. teres** (Goode & Bean) J. & G.

Body terete, moderately elongate, about \(\frac{2}{2}\) length of head. Snort short, moderately pointed, projecting somewhat beyond lower jaw, its length 63 in head, 23 times the very small eye. Tube of anterior nostril shorter than eye. Cleft of mouth 4 in head; front of eye behind middle of cleft. Lower jaw rather short and weak; tongue not free in front. Head  $S_3^2$  times in trunk. Trunk and tail equal in length. Dorsal (as in C. scuticaris) beginning in front of middle of head.\* Distance from tip of shout to front of dorsal 22 head. Dorsal of moderate height, its longest ray nearly equal to snout. End of tail acute. Anal well developed, lower than dorsal. Pectorals minute, pointed, usually shorter than eye. Gill-openings vertical (as in *C. scuticaris*), the length of one slit slightly more than breadth of isthmus, about equal to length of snont. Lateral line distinct, the pores well separated. Head without conspicuous pores. Uniform clear brown, paler below, whitish on the head: fins all pale. West Florida.

(Sphagebranchus teres Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 359. No. 582 may perhaps stand as—

#### **582. O. mordax** (Poey) J. & G.

The identity of the species found on our coast with Macrodonophis mordax Poey is certain, but the "Crotalopsis punctifer" of Kaup is somewhat questionable. The small vomerine teeth are in two series.

On page 359, substitute for the description of 583, Ophichthys triserialis:

Light olive brown; a dorsal series of large round black spots, besides two alternating lateral series; head with small spots above and below, those below elongate; dorsal and anal narrowly edged with black; pectorals with a few spots. Skin of head with longitudinal wrinkles. Length of head a little more than one-third its distance from vent. Head subconical, the snout rather long and pointed.

Bull. Nat. Mns. No. 16——57

Mouth large, the gape  $2\frac{2}{5}$  in head. Eye moderate, 2 in snout, a little behind the middle of the gape. Teeth pointed, fixed, those in jaws biserial, those on vomer in one series. Pectoral  $3\frac{1}{4}$  in head; dorsal beginning well in front of its tip. Tail a little longer than body. Pacific (and Atlantic?) coast of Tropical America; abundant southward; north to Southern California (fide Cooper).

(Muranopsis triserialis Kaup, Apodes, 1856, 12: Herpetoichthys callisoma Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 475: Ophisurus californiensis Garrett Proc. Cal. Acad. Nat. Sci. iii, 66; Günther, viii, 58.)

Page 359. After Ophichthys triscrialis add:

# 583 (b). O. macrurus Poey.

Uniform light olive, the back closely punctate, but not dark; fins all pale, the dorsal and pectoral without dark shades. Body not very slender. Head pointed, the upper jaw projecting. Eye large, more than half snout, placed above middle of gape. Gape  $2\frac{9}{3}$  in head. Teeth subequal, short, slender, and sharp, more or less directed backwards; all of them biserial; no canines. Nasal tubes short, inconspicuous. Tail twice length of rest of body. Head slightly more than half trunk, nearly 9 in total. Pectorals long,  $2\frac{1}{2}$  in head; dorsal beginning opposite anterior third of pectoral; distance from snout to front of dorsal  $2\frac{1}{3}$  in distance to vent. Gill-openings small, rather near together. L. 15 inches. Cuba to Texas. Closely allied to O. parilis (Rich.), with which it is identified by Dr. Günther; but that species has very long nasal tubes.

(Poey, Repert. Fis. Nat. Cuba, ii, 256: Oxyodontichthys macrurus Poey, Anal. Soc. Hist. Nat. Esp. 1880, 254; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 260.)

#### **583** (c). **O. chrysops** Poey.

Light olive-green; vertical fins edged with black; tip of pectoral broadly dusky. Teeth all biserial, none of them very large or canine-like. Head conical, the snout short but rather sharp. Mouth rather large, its gape about  $2\frac{3}{5}$  in head; jaws and top of head with numerous dark-colored pores. Dorsal beginning a little before tip of pectoral. Lateral line of rather coarse pores. Length of head and body about  $2\frac{5}{7}$  times in total length. West Florida to Havana, in rather deep water. The reproductive apparatus in this species in both sexes resembles that of ordinary fishes, the ovaries in the female being very large, with the eggs exceedingly numerous.

(? Ophisurus gomesii Castelnau, Anim. Amér. Sud. Poiss. 1855, 84, Rio Janeiro: ? Ophichthys gomesii Günther, viii, 60: Ophisurus chrysops Poey, Mem. Cuba, ii, 321; Poey, Syn. Pisc. Cub. 1868, 425: Oxyodontichthys chrysops Poey, Anal. Soc. Hist. Nat. Esp. 1880, 254.)

Page 359. After Ophichthys occilatus add:

# 170 (b).- PISODONTOPHIS Kaup.

(Pisoodonophis Kaup, Apodes, 1856, 15: type Ophisurus cancrivorus Rich.)

Teeth all, or nearly all, more or less rounded or granular. Otherwise essentially as in *Ophichthys*. (π:σον, pea; δδούς, tooth; δφις, snake.)

581 (b). P. longus (Poey) Goode & Bean.

Body extremely elongate, its greatest depth little more than 4 length of head. Snort rather pointed, its length 5% in head and twice diameter of eye. Tubes of anterior nostril nearly as long as eye. Cleft of mouth 3 in head; the front of eye slightly behind its middle. all blunt and rounded, biserial; those of the front of jaws considerably larger than the rest. Head 4 in trunk. Head and trunk 12 in tail. Dorsal beginning at nape, at a point slightly nearer base of pectoral than eye, the fin of moderate height, higher than the anal; end of tail sharp. Pectorals extremely small, rounded, broader than long, the breadth of their bases equal to depth of gill-opening. Ground color dark brown, pale below; each side with 2 series of round, whitish blotches, about 40 spots in each series; spots somewhat largest and most distinct anteriorly, where their diameter is nearly equal to length Head with irregular round whitish spots on each side. Dorsal brownish, margined with dusky; other fins pale. Florida to Cuba.

(? Muræna acuminata Gronow, Syst. Ichth. Ed. Gray, 1854, 21: Ophisurus longus Poey, Rep. Fis. Nat. Cuba, 1868, 254: Ophichthys acuminatus Günther. viii, 83.)

Page 360. After Myrichthys tigrinus insert:

#### 171 (b).—MYROPHIS Lütken.

(Lütken, Vid. Med. Naturh. Foren. Kjöbenh. 1851, 1: type Myrophis punctatus Lütk.)

Body elongate, subcylindrical, scaleless. Vertical fins low, meeting around the tail, the dorsal beginning far behind the pectoral, which is small. Mouth moderate, its eleft extending beyond the eye; upper jaw longest; teeth moderate, in 1-3 series. Nostrils on the margin of the upper lip, the anterior tubular. Size small. ( $\mu\nu\rho\rho\sigma_5$ , Myrus;  $\sigma\phi\iota\sigma_5$ , snake.)

# **585** (b). **M. lumbricus** J. & G.

Light olive, everywhere except below finely punctulate; some very faint roundish yellowish spots; eyes green; lower side of head with steel-blue luster. Body worm-shaped, tapering backwards and scarcely compressed; diameter of head less than that of body. Head very small,

slender, and pointed, the narrow upper jaw much projecting; eye much nearer angle of mouth than tip of shout, its length 2 in shout. Teeth rather strong, slender, sharp, apparently uniserial, the series on vomer largest. Gape short, 4 in head; hasal tubes very short. Pectorals minute, rounded, scarcely larger than eye. Dorsal beginning nearer gill-opening than vent, at a distance behind gill-opening equal to length of head. Head  $10\frac{2}{3}$  in total; head with trunk  $1\frac{2}{5}$  in tail; head 4 in trunk. Height of body 30 in length. Galveston, Texas.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 261: ?? Myrophis punctatus Liitken, l. e.: ?? Myrophis longicallis Kaup, Apodes, 30.)

#### 585 (c). M. microstigmius Poev.

Distinguished from *M. lumbricus* chiefly by the more posterior insertion of the dorsal, which begins at a point midway between gill-opening and yent. (*Pocn.*) Cuba to Southern Florida.

(Poey, Repert. Fis. Nat. ii, 250; Günther, viii, 51.)

Page 360. In *Neoconger mncronatus* the anal-fin is well developed for its entire length; not "rudimentary," as stated by Girard.

Page 363. After Conger niger add:

#### 588 (b). C. candicula Bean MSS.

Olivaceous. Head a little more than 1½ times in trunk, 6 times in total length; tail short, its length exceeding that of rest of animal by length of head without shout. Eye equal to shout, 4½ in head; lips moderate; anterior nostril tubular; lower jaw included; eleft of mouth reaching hinder margin of pupil; patch of vomerine teeth ⅓ length of eye; 38 close-set teeth in outer series of upper jaw; behind them 6 conical teeth directed partly forward; teeth in both jaws biserial. Dorsal beginning over posterior part of pectoral; pectoral a little more than ⅓ head. Pensacola, Florida, in deep water. (Bean.)

(Bean, Proc. U. S. Nat. Mns. 1882.)

Page 370. After Notacanthus chemnitzi add:

# 595 (b). N. phasganorus Goode.

Body much compressed, its greatest width about one-third its height. Head everywhere covered with very small scales, its bones very flexible but protected by leathery skin. Interorbital width more than length of snout, 4 in head, twice diameter of eye. Mandible twice length of eye maxillary considerably greater. Teeth of upper jaw slender, blunt, close-set, like comb-teeth, 32 on each side; teeth of lower jaw shorter, slenderer, in two rows; palatines with villiform teeth in about two se-

ries. Distance from snout to dorsal 2\frac{3}{4} times length of head, its length nearly twice length of head; anal beginning close behind vent, its length half the body. Pectoral short and rounded, its length (uncertain) about one-third the head. Ventrals broad, with peduncle-like bases thickly covered with scales; closely adjacent, separated by a narrow groove. Head 7\frac{1}{2}; depth 9. D. X; A. XIX, 130; P. about 17; V. II, 9; B. 8; scales about 20-400-36. Grand Bank, Newfoundland. (Goode.) One large specimen known, taken from the stomach of a Somniosus.

(Goode, Proc. U. S. Nat. Muš. iii, 535, 1880.)

Page 373. To the account of Tylosurus hians add:

Body slender, very strongly compressed, nearly twice as deep as broad. Tail without keel. Candal deeply and subequally forked; ventrals inserted much behind middle of body (not a little before middle, as stated by C. & V.). Side with a series of faint roundish bluish blotches; pectoral blackish, pale at base. Head  $3\frac{1}{2}$  to  $3\frac{2}{3}$  in length in adult examples. D. 24; A. 25.

(? Belone hians C. & V. xviii, 432, and Günther, vi, 248: Belone maculata Poey, Mem. Cuba, ii, 290.)

Page 373. Instead of Tylosurus latimanus read:

### **597. T. caribbæns** (Le S.) J. & G.

To the description in the text add:

Body very elongate, subterete, the depth little more than the breadth of body, and considerably less than length of postorbital part of head. Tail scarcely depressed, but with a small black dermal keel. Young and half-grown specimens with the last rays of dorsal elevated, nearly or quite as high as anterior rays; adults with the posterior rays of dorsal low, not longer than the median. Caudal unequally forked. Jaws rather strong, slenderer in the young. Scales very small. Tip of pectoral black. Head 3½ in adults; 3 in young. D. 24; A. 22. L. 4 feet. West Indies; occasional northward.

(Belone carribaea Le Sueur, Journ. Acad. Nat. Sci. Phila. ii, 127, 1823: Lelone latimana Poey, Mem. Cuba. ii, 292, 1860: Belone caribbaea Günther, vi, 241: Belone latimanus Günther, vi, 249.)

Page 374. After Tylosurus exilis add:

**600** (b). **T. gladius** Bean MSS.

Green; pectorals and dorsal blackish. Body robust, little compressed, its greatest breadth a little more than  $\frac{2}{3}$  greatest depth; caudal peduncle slightly depressed, a little broader than deep, with a slight black dermal keel. Head broad, interorbital space nearly  $\frac{2}{3}$  length of postorbital part of head, with a broad, shallow, nearly naked median

groove, which is wider behind and forks at the nape. Supraorbital bones with radiating striæ. Jaws unusually short, stiff, strong, rapidly tapering forwards; large teeth of jaws very strong, knife-shaped. Upper jaw from eye about 13 times as long as the rest of head. Eye large, 7 in snout,  $2\frac{2}{3}$  in postorbital part of head, and  $1\frac{4}{5}$  in interorbital width. Maxillary entirely covered by the preorbital. Cheeks densely scaled; opercles mostly naked except along the anterior margin. Seales of body minute, especially above. Dorsal fin low posteriorly; the height of its anterior lobe equaling that of anal, or length of postorbital part of head; its longest ray  $\frac{2}{5}$  the base of the fin; caudal lunate, its lower lobe nearly half longer than the upper; middle rays about as long as eye. Ventrals inserted midway between base of caudal and middle of eye, their length a little less than that of pectoral, and equal to postorbital part of head. Head 31; depth 13. D. I, 22; A. I, 20; P. 14. Pensacola, Florida; a large species, remarkable for the great strength of its short jaws.

(Bean, Proc. U. S. Nat. Mus. 1882.)

Page 374. Instead of Tylosurus longirostris read:

509, T. marinus (Bloch & Schn,) J. & G.

To the synonymy add:

(Esox belone, var. marinus Bloch & Schneider, Syst. Ichth. 1801, 391.)

Page 377. After Hemirhamphus rosæ add:

b. Ventrals much nearer base of caudal than head.

#### 604 (b). H. brasiliensis (L.) Gthr.—Balao.

Greenish above, sides silvery, the lateral silvery stripe very indistinct. Body not very slender, compressed. Lower jaw (from end of upper jaw)  $4\frac{2}{5}$  in length from its tip to base of caudal. Head, without mandible, 5 in length from tip of upper jaw. Premaxillaries broader than long. Eye large, equal to interorbital space,  $\frac{2}{3}$  postorbital part of head. Ventrals inserted very far back, midway between base of eaudal and tip of peetoral; vertical fins scaly; anal much smaller than dorsal; last ray of dorsal slightly produced; pectoral  $\frac{3}{4}$  length of head; ventrals  $2\frac{3}{4}$  in head; caudal deeply forked, the lower lobe longest. Head (with lower jaw)  $2\frac{3}{4}$ ; depth  $6\frac{2}{3}$ . D. 14; A. 12; Lat. l. 53. Tropical America; a specimen lately taken on the coast of Virginia by Dr. J. T. Wilkins.

(Esox brasiliensis L. Syst. Nat. i, 517, in part, the name and fin rays taken from Maregrave's account of Tylosurus timucu; Günther, vi, 270: Esox brasiliensis, Bl. & Schn. 392: Hemirhamphus marginatus and balao Le Sueur, Journ. Acad. Nat. Sci. Phila

ii, 135, 136, 1823: Hemirhamphus browni and pleii C. & V. xix, 13, 19: Hemirhamphus pleii Günther, vi, 269: Hemirhamphus filamentosus Poey, Mem. Cuba, ii, 297, 1860.)

Page 377. The genus 183 (b) Euleptorhamphus, should probably be recognized. After Euleptorhamphus longirostris add:

# 183 (c).—CHRIODORUS Goode & Bean MSS.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882: type Chriodorus atherinoides Goode & Bean.)

Body and fins as in Hemirhamphus, but both jaws very short, not at all produced, each with two series of large, tricuspid, incisor teeth, which form a continuous cutting edge. Maxillary anchylosed to premaxillary. Ventral fins small, median. (20519, want; 80005, lance.)

# 605 (b). C. atherinoides Goode & Bean MSS.

Light olive; sides with a narrow, silvery band. Interorbital space broad, unevenly convex, its width equal to eye, which is  $3\frac{1}{6}$  in head, as long as snout; premaxillaries much broader than long, their edges concave; maxillary 4 in head; mandible  $2\frac{1}{4}$ , its tip broadly rounded, not at all produced. Dorsal opposite anal and entirely similar to it; both fins elevated in front, but not falcate, their longest rays half head; caudal moderate, deeply and subequally forked; ventrals  $2\frac{1}{6}$  in head, their insertion midway between snout and base of caudal; pectorals  $1\frac{1}{2}$  in head; vertical fins with small scales. Scales moderate, deciduous. Head  $4\frac{3}{6}$ ; depth  $6\frac{3}{4}$ ; breadth of body  $\frac{3}{6}$  its depth. D. I, 14; A. I, 15; V. 6; P. 12; scales 7-46-3. L.  $8\frac{1}{2}$  inches. Key West, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 379. Before Exocætus californicus insert:

#### 607 (b). E. hillianus Gosse.

Dark green, silvery below, tinged with pinkish; dorsal translucent, with a large black blotch on upper anterior half; caudal brick-red; pectoral translucent, dusky; ventrals more or less dusky, with a small black spot at base of outer ray. Body moderately compressed. Head short, the short shout one-fourth its length; eye 3 in head, equal to the flat interorbital space. Pectoral reaching middle of anal, its length  $1\frac{1}{3}$  in body; its second ray simple, scarcely shorter than third. Insertion of ventral slightly nearer root of caudal than tip of shout, its tip extending slightly past front of anal, its length  $1\frac{1}{4}$  in head. Dorsal very high, its anterior rays reaching anal. Head  $4\frac{1}{3}$ ; depth 5; D. 12; A. 14; scales 38–5. L. 8 inches. West Indies, north to West Florida and South Carolina.

(Gosse, Nat. Sojourn Jamaica, 11: Poey, Mem. Cuba, ii, 301: Günther, vi. 384.)

Page 379. Instead of Exocatus noreboracensis read:

### 609. E. rondeletii C. & V.

The specimen described in the text came from the open sea, south of Newfoundland. The species is well distinguished from E. noreboracensis, by the black ventrals, the larger anal and shorter dorsal, the base of the anal being more than  $\frac{2}{3}$  that of the dorsal; the head is blunt and the eye comparatively small; dorsal beginning slightly before anal; caudal large, its lower lobe half longer than head. D. 11 or 12; A. 11 or 12 (not 9): Lat. l. 42. New England to Mediterranean Sea.

(Cuv. & Val. xix, 115; Günther, vi, 293.)

Page 379. After Exocutus rondeletii read:

#### 610. E. noveboracensis Mitchill.

Dark bluish; pectorals blackish at tip, with a median whitish shade; ventrals white. Head rather slender, the snont not blunt; eye very large,  $2\frac{5}{6}$  in head; interorbital space rather narrow. Pectoral shorter and narrower than in *E. rondeletii*, barely reaching last ray of dorsal; first ray of pectoral divided; ventrals extending past anal, their insertion midway between preopercle and base of caudal; dorsal beginning considerably in advance of anal, the length of its base more than twice that of anal; lower lobe of caudal not  $\frac{1}{3}$  longer than head. Head  $4\frac{2}{3}$ ; depth  $5\frac{1}{3}$ . D. 14; A. 9; Lat. l. 45. Atlantic coast; specimens examined from Wood's Holl and Pensacola.

(Mitchill, Amer. Monthly Mag. ii, 233, 1817; Dekay, New York Fauna, Fish, 230; C. & V. xix, 99; Exocutus melanurus C. & V. xix, 191.)

Page 379. The description in the text of "E. melanurus" is taken from an adult example of E. exiliens, the young of which is described as E. exiliens on page 380. E. melanurus is therefore to be suppressed. E. exiliens is comparatively slender, the anal fin beginning opposite front of dorsal, its base  $\frac{3}{4}$  length of base of dorsal; lower candal lobe short, shorter than head. D. 11; A. 12 (not 9, as erroneously stated in the text).

Page 383. Instead of the foot-note add:

#### 614 (b). S. affine (Gthr.) J. & G.

The specimen from St. John's River, described in the foot-note on page 583, belongs to 8. affine. The body, in the female, is marked by silvery cross-streaks, which are very distinct in life.

Page 384. In S. lonisiana the rings are usually 20+38 in number; the dorsal rays 32 to 35.

Page 384. After Siphostoma louisiana add:

#### 615 (b). S. floridæ J. & G.

Dark green, with paler streaks; tail faintly barred. Body slender; snout long, one-third longer than rest of head; nape and opercles without keel; dorsal fin on 1+6 or 7 rings. Tail one-fifth longer than trunk; rings 18+31. Caudal pouch in male on 18 rings. Head about 6; D. 27; L. 8 inches. North Carolina to Western Florida; abundant at Pensacola and Beaufort.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

Page 384. After Siphostoma californiense add:

#### 616 (b.) S. griscolineatum (Ayres) J. & G.

Very close to *S. californiense*, but the size smaller, the snout shorter, and the number of rays and rings different. Dorsal covering 1+9 rings. Snout in head 1<sup>3</sup> times. Dorsal rays 36 to 41; rings 18 to 19+39 to 42. L. 10 inches. San Francisco to Puget Sound.

(Syngnathus griscolineatus Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 14, etc.)

# **616** (c). **S. bairdianum** (Dum.) Swain.

Blackish, with pale lines; tins mottled. Body unusually stout, with short head and tail. Shout short, compressed, with a sharp keel above, in the male just as long as head, probably longer in female. Nape and opercle without keel. Dorsal fin low. Rings 18 + 31. D. 34, placed on 1 + 7 rings. Ten rings on tail behind candal ponch. Head  $7\frac{2}{3}$  in length. Santa Barbara, California.

(? Syngnathus bairdianus Duméril, Hist. Nat. Poiss, ii, 1870, 574; "Coast of Mexico, near California" (dorsal said to be inserted on 3 + 6 rings); Swain, Proc. U. S. Nat. Mns. 1882.)

Page 384. The species described in the foot-note as Siphostoma dimidiatum is a valid species, and should stand as—

#### 617 (b). S. auliseus Swain."

Syngnathus dimidiatus Gill was based on short-nosed examples of S. leptorhynchus.

Swain, Proc. U. S. Nat. Mus. 1882.

The following analysis of the species of Siphostoma found in the United States is given by Mr. Swain (Review of the North American Pipe-fishes, l. e.):

a. Top of head strongly carinated.

b. Breast-shields not covered by soft skin; lower jaw slightly included; opercle with a prominent ridge; snont short; belly concave; dorsal rays 20, its base covering 1 + 4 rings; rings 18 + 30; body with 12 brown crossbands.

Zatuoris.

Page 385. After Siphostoma punctipinne add:

xx. Top of head with a strong interrupted median crest. (Corythrichthys Kaup.)

# 616 (c). S. zatropis J. & G.

Brownish, with ten broad dark cross-bands which encircle the tail but do not cross the belly anterior to the vent; snout whitish, with two narrow dark bands; lower part of head with white cross-streaks. Snout as long as postorbital part of head, keeled above. Head small. Occiput and nape with a strong, compressed crest, on each side of which is a longitudinal ridge; opercle with a median keel. Ridges of body very prominent. Tail one-third longer than rest of body. Dorsal on 1+4 rings. Dorsal rays 20; rings 18+30. Head 9. Gulf of Mexico, north to Pensacola.

(?? Corythroichthys albirostris Kaup, Lophobranchs, 25: Syngnathus albirostris Günther, viii, 170; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 264; Swain, Proc. U. S. Nat. Mus. 1882.)

Page 386. The identity of 619 (a) with the European *H. heptagonus* (antiquorum) is questionable. None of the American examples seen by us are spotted, and their spines are stronger than in European examples.

- aa. Top of head with a slight keel or none; opercle without prominent longitudinal ridge.
  - c. Dorsal covering 1 + 9 rings; snout usually long.

    - dd. Rings 18 to 19 + 39 to 42; dorsal rays 36 to 41; top of head slightly keeled.

      GRISEOLINEATUM.
  - cc. Dorsal covering 1+7 (rarely 1+6) rings.

    - ee. Rings 16 to 19 before vent.
      - f. Dorsal fin low, not longer than head.
        - g. Rings 18+31; dorsal rays 34; snont short; body little elongate.

BAIRDIANUM.

FLORIDÆ.

- ccc. Dorsal covering 3 + 5 rings; rings 20 or 21 + 36 to 38; dorsal rays 32 to 37; belly flat or slightly concave; snout medium.....Louisianæ.

Page 386. After Hippocampus heptagonus add:

### 619 (b). H. guttulatus Guich.

Dark brown, marbled with darker, and usually everywhere spotted with whitish, the spots most numerous posteriorly. Tubercles on body generally obtuse and blunt; coronet low; snout usually a little longer than preorbital part of head. Dorsal rays 17. Supraorbital spine obliquely truncate, compressed. Size rather large. Tropical seas, north to our South Atlantic and Gulf coast.

(†† Hippocampus guttulatus Cuvier, Règne Anim.: Hippocampus guttulatus Günther, wii, 202: Guichenot, in Ramon de la Sagra Poiss. Cuba, 174, the West-Indian form, which is apparently different from the European species called "guttulatus.")

# 619 (c). H. hudsonius Dek.

Dusky, without spots, but with pale grayish blotches, which are sharply edged with paler and blackish; some of these between eyes and on neck, the most distinct blotch forming an hour-glass shaped figure, extending down each side of back; similar blotches on belly and tail. Dorsal with a submarginal dark band. Depth equal to length of head. Snout 1\frac{1}{3} in rest of head. Spines of head weak, provided with cirri; spines of body all short and bluntish. Dorsal on 3\frac{1}{2} of the 11 body rings. D. 19. Atlantic coast, from Cape Cod southward. (Described from No. 19520, U. S. Nat. Mus., from Beaufort, N. C.)

(Dekay, N. Y. Fauna, Fish. 1842, 322.)

# **619** (d). **H.** stylifer J. & G.

Brownish, with darker bars; snout blackish. Snout notably longer than postorbital part of head; supraocular and temporal spines long, simple; a long median spine in front of coronet; coronet stout, high, its spines slender, abruptly spreading. Spines of body very long and slender, each ending in a filament; these enlarged on each alternate plate of the neck, and about every fourth plate on body and tail; dorsal and upper lateral ridge usually armed and sometimes lower lateral ridge; two strong spines at base of pectoral; body with about 50 developed spinous processes besides numerous smaller points. D. 16, covering about 4 body rings; rings about 12 + 31. Coasts of Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 265.)

#### 619 (e). H. zosteræ J. & G.

Olive green; sides of head mottled with paler; dorsal marbled with dusky, its margin (in 3) broadly red. Snout very short, not more than half rest of head; supraorbital spines diverging, each with a small spine before it. Coronet high, two-thirds length of snout; its filaments

about as long as snout. Spines on body well developed. Dorsal on 2 +1 rings; the fin high and very short. D. 12; rings 11 + 26 to 30. L. 2 inches. Pensacola Bay.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 265.)

Page 391. The ventral rays in *Aulorhynchus* are I, 4, not I, 5 as erroneously stated in the text.

Page 403. Mugil mexicanus is certainly specially identical with Mugil albula, and may, therefore, be suppressed.

Page 405. The types of Atherina carolina C. & V., examined by us in the Museum at Paris, show the following additional characters:

A true *Atherina*. Eye large,  $2\frac{1}{2}$  in head. Scales nearly or quite entire. Spinous dorsal wholly in advance of the vent. Ventral reaching past front of vent and dorsal nearly to it. Head  $4\frac{1}{2}$ . Lat, 1.52.

Page 406. In *Labidesthes*, the premaxillaries, though broadened behind, are much narrower than in *Menidia*, and but little broader than in *Atherina*.

Page 406. The date of the name Menidia is apparently 1836.

Page 407. Instead of Menidia bosci read:

# 640. M. vagrams subsp. Inciniata Swain, sp. nov.

Coast of North Carolina. The synonymy given in the text (page 407) belongs to No. 644.

Page 407. In *Menidia ragrans* the scales are all very firm, with rough edges. A. 1, 15 to I, 18. Silvery band broad; back with lines of dots following the rows of scales; pectoral and caudal yellowish in life. Soft dorsal and anal scaly. Florida to Texas.

Page 408. After Menidia notata add:

#### **642** (b). M. audens Hay, sp. nov.

Color and form of *M. notata*; edges of scales somewhat dotted; a dusky streak at base of anal. Head rather broad and flat above. Mouth small. Eye 3 in head, equal to snout and to interorbital space. Vent a longitudinal slit, its length two-thirds diameter of eye. First dorsal spine inserted immediately above anterior part of anal slit, slightly nearer base of caudal than snout. Pectorals extending to beyond bases of ventrals, their length four-fifths head. Ventrals reaching vent. Interspace between dorsals twice diameter of eye. Top of head covered with large scales. Lateral silvery band on fifth row of scales and edges of fourth and sixth rows; the extreme parts of fifth row not included in it. Scales with entire edges, which are nearly straight, so that

each scale is angulated behind. Soft dorsal naked. Head 4½; depth 6. D. IV or V-I, 8 or 9; A. I, 17 or 18; scales 45-10. L. 3 inches. Mississippi River; the types from Memphis and Vicksburg. (*Hay* MSS.)

Page 408. Under M. beryllina read "two half-row of scales," instead of "21."

Page 408. Instead of Menidia brasiliensis read:

# 644. M. bosci (Cuv. & Val.) Swain.

Distinguished from *M. notata* by the deeper body and stronger teeth. The soft dorsal and anal, as in other smooth-scaled species, are free from scales. D. IV-I, S; A. usually I, 24. South Carolina to Florida.

(Atherina menidia L. Syst. Nat.: A. bosci C. & V. X. 465; not A. brasiliensis Q. & G.)

Page 415. The genus and species "Argyrotævia vittata" should be erased from the system. We have little doubt that they are based on a specimen of Ammodytes americanus. Our alleged species of Ammodytidæ are perhaps all forms of Ammodytes tobianus L. A. personatus, at least, is not distinguishable from A. americanus.

# Page 417. To the synonymy of Echeneis remora add:

(Echeneis squalipeta Daldorf Nat. Selskab. ii, 157, about 1785; and Günther ii, 157. If the subgenus Remora Gill, be adopted as a genus, which may be desirable, this species should stand as Remora squalipeta (Dald.) J. & G.)

Page 418. Elacate canada is known in Florida as "Sergeant-fish," from its lateral stripes; also, as "Snooks" and "Ling."

Page 420. Instead of Tetrapturus albidus read:

#### 663. T. indicus C. & V.

Tropical seas, northward to the Grand Banks, on our Atlantic coast. Instead of the synonymy in the text, substitute the following:\*

(C. & V. Hist. Nat. Poiss. viii, 1831, 286: Tetrapturus herschelii Gray, Ann. Nat. Hist. i, 313, 1838: Tetrapturus herschelii Lütken, Spolia Atlantica, 1880, 441: Histiophorus herschelii Günther, ii, 513: Tetrapturus albidus Poey, Mém. Cuba, ii, 237, 1858: ? Tetrapturus amplus Poey, Mém. Cuba, ii, 243: Histiophorus brevirostris Gthr. and Playfair, Fish. Zanzibar, 1866. 53: Tetrapturus georgii Lowe, Proc. Zoöl. Soc. Lond. viii, 36, 1840: Tetrapturus lessonii Canestrini, Arch. Zoöl. i, 259, 1861; Goode, Proc. U. S. Nat. Mus. 1881, 418 (detailed review of family): not Tetrapturus belone Raf.=T. imperator (Bloch & Schneider) Goode, a distinct species, known only from the Mediterranean.)

<sup>\*</sup>This synonymy is given in accordance with the views of Dr. Lütken, who recognizes but five species of Xiphiida. This view is probably correct but, as has been pertinently observed by Professor Goode, the identity of the American species called Tetrapturus albidus and Histiophorus americanus, with their Old World representatives, is yet unproven, and in many respects it is desirable to retain the American names until this identity is shown. "To unite species from widely distant localities, without ever having seen them, is very disastrons to a proper understanding of the problems of geographical distribution." (Goode, Proc. U. S. Nat. Mus. 1881, 427.)

Page 422. After Trichiurus lepturus\* add:

### 212 (b).—BENTHODESMUS Goode & Bean.

(Goode & Bean, Proc. U. S. Nat. Mus. 1881, 379: type Lepidopus elongatus Clarke.)

Body naked, much compressed, band-like, tapering gradually backward from the vent; caudal peduncle very slender, the caudal fin small. but well developed; vent much nearer snout than tip of tail. line simple, nearly straight, in a deep, wide furrow. Head compressed: the snort gibbous near its tip; top of head very flat, concave between the eyes, without occipital crest; lower jaw with a stout cutaneous appendage. Three very long, simple, compressed teeth on each premaxillary in front; outside of these a few minute teeth, and behind them a row of large sharp teeth: lower jaw with a single row of rather large, pointed teeth, those in middle of the jaw largest. Palatine teeth Nostrils horizontal. Dorsal fin nearly uniform, the spines and soft rays similar; anal extremely low, preceded by a scale-like appendage. Caudal forked. Ventrals each reduced to a minute, scale-like spine, inserted below pectorals. Gill-rakers short, spiny, in one series on first and second arch; obsolete on third and fourth. Deep water. (βενθός, deep : δεσμός, band.)

### 666 (b). B. elongatus (Clarke) G. & B.

Silvery, with dark traces on head and tail. Length of caudal peduncle half greatest depth of body, its least depth one-third interorbital width, which is 4 in head. Snout  $2\frac{1}{2}$  in head; maxillary not reaching front of eye, as long as postorbital part of head. Gill-rakers 13 on first arch. Dorsal fin inserted above middle of opercle; pectoral as long as maxillary. Head  $7\frac{1}{2}$ ; depth 30. D. 154; A. 100; P. 12; V. I, 1. (Goode & Bean.) Deep seas; known originally from Hokitika, New Zealand; a specimen lately taken from the stomach of a halibut on the Grand Banks of Newfoundland.

(Lepidopus elongatus F. E. Clarke, Trans. New Zealand Inst. xi, 294, 1878, pl. xiv; Goode & Bean, Proc. U. S. Nat. Mns. 1881, 379.)

Page 424. After Scomber pneumatophorus read:

### 667 (b). S. colias Gmelin .- "Spanish Mackerel" of Europe.

Our Atlantic and Pacific representatives (grex Mitch.; diego Ayres) of S. pneumatophorus seem to be identical, but both differ in some respects from the European "Spanish Mackerel." S. colias Gmel. has the head longer, 3½ to 3¾ in length (instead of 4); its spinous

<sup>\*</sup> This species is known as "Sabre-fish" and "Silver Eel," on the coast of Texas.

dorsal is lower, the longest spines not more than half of head; the color is distinctly different. In S. pneumatophorus the dark bands on the back are broader than the interspaces, as broad as pupil; these are usually confluent below with a narrow dark lateral streak, which runs about on the level of the upper edge of the pectoral; below this streak the sides and belly are immaculate. In S. colias (specimens from Charleston, S. C., and from Genoa) the dark dorsal bands are much narrower, not so broad as the interspaces and more wavy; the lateral streak is obsolete or represented by a line of dots, and the sides below are marked by numerous irregular, wavy vertical streaks, spots, and reticulations, of a dull pearly-gray color, which are usually broader than the interspaces; longest D. spine more than ½ head. The fin rays are the same in the two species.

(Scomber colias Gmelin, Syst. Nat. i, 1329, 1788; C. & V. viii, 309; Gthr. ii, 361: Scomber dekayi Storer, Fish. Mass. 52.)

Page 424. In the description of Scomber scombrus read "depth 5," not 54.

Page 425. For Auxis rochei read:

669. A. thazard (Lac.) J. & G.

And add to its synonymy:

(Scomber thazard Lac. Hist. Nat. Poiss. iii, 9, 1802: Auxis taso C. & V. viii, 146.)

Page 427, last line, omit the words "P. 10."

Page 430, second line, omit the word Baird.

Page 432. The following diagnoses of the species of *Trachurus* may be substituted for those given in the text:

680. T. picturatus (Bowdich) J. & G.-Horse Mackerel.

Body elongate, little compressed, the depth 5 in length; scutes 50 + 46 to 48, the anterior scutes one-third lower than the posterior, their height 2\frac{1}{3} in diameter of eye; curve of lateral line scarcely shorter than straight part; maxillary scarcely reaching beyond front of eye, 2\frac{2}{3} in head; lining of operele scarcely blackish. Coast of Southern California to Chili; Mediterranean.

(Seriola pieturata Bowdich, Excursion Madeira, 1825, 123: Trachurus cuvicri Lowe, Trans. Zool. Soc. Lond. ii, 183, 1837: Caranx trachurus 2ème subdiv. C. & V. iii, 18: Caranx amia Risso, Ichth. Nice, 1810, 74 (not Scomber amia L.): Caranx symmetricus Ayres, Proc. Cal. Ac. Nat. Sci. i, 62, 1855: Trachurus fallax Capello, Cat. Peix. Portugal, 1867: Trachurus rissoi Giglioli, Cat. Anfibi. Pesci. Ital. 1880, 27.)

#### **681. T. samms** Raf.\*

Body comparatively deep and compressed, the depth 4; scates 34 to 36+36 to 38, the anterior scates scarcely lower than the posterior, their height three-quarters diameter of eye; length of curve of lateral line  $1\frac{3}{5}$  to  $1\frac{3}{5}$  in straight part; maxillary reaching past front of pupil,  $2\frac{1}{4}$  to  $2\frac{1}{2}$  in head; lining of opercle dusky. Coasts of Europe; occasional on our South Atlantic and Gulf coasts.

(Scomber trachurus L. Syst. Nat. Cuv. & Val. ix, 11: Trachurus trachurus Day, Fish. Gt. Brit. 1880, 124: ?? Caranxomorus plumierianus Lac. Hist. Nat. Poiss. iii, 84, pl. 11: Trachurus saurus Raf. Caratteri, etc. 1810, 20.)

Page 435. Caranx pisquetus is known on the Gulf coast as "Hard-tail" or "Jurel"; Decapterus punctatus as "Cigar-fish". The lateral sentes in Caranx cibi are about 28 in number, as in C. beani, which is possibly the young of the same species.

Page 436. Instead of Caranx falcatus read:

### 689. C. amblyrhynchus C. & V.

Add to its synonymy:

(Caranx amblyrhynchus C. & V. ix, 100, pl. 248.)

Page 437. Caranx fallax can hardly be said to have "canine teeth," the teeth being smaller than in C. hippus.

Page 443. Trachynotus goreensis, the "Permit" of the Florida coast, is probably distinct from T. ovatus, differing in the much more elongate form. It reaches a large size. Trachynotus glaucus, the "Gaff-top-sail Pompano," rarely grows beyond a foot in length. In the description of the latter the words "Lower California" should be erased.

Page 444. Instead of Scriola lalandi read:

# 701. S. dorsalis (Gill) J. & G.

The identity of the Californian "Yellow-tail," with the *Seriola lalandi* of the Atlantic is questionable. For the synonymy of the species substitute:

(Halatractus dorsalis Gill, Proc. Ac. Nat. Sci. Phila, 1863, 84.)

A species apparently the true *lalandi*, however, occurs on the coast of Florida and may be added as—

#### 701 (b). S. Inlandi C. & V.

It agrees in general with the description of No. 701, but the mouth

\*The description of *T. saurus* given in the text was taken from specimens from Venice, belonging to a third species or variety (declivis Jenyus) not yet found in America north of Cape San Lucas. Its scutes are usually 38 to 40+38 to 42. In form and other characters it is intermediate between saurus and picturatus.

is larger, the maxillary  $2\frac{2}{3}$  in head, instead of  $2\frac{2}{3}$ ; and the dorsal rays are V-I, 32 or 33. Florida to Brazil; reaching a large size.

(C. & V. ix, 208; Günther, ii, 463: Seriola gigas Poey, Mem. Cuba, ii, 230.)

Page 445. After Seriola-rivoliana add:

702 (b). S. falcata C. & V.-"Rock Salmon" (Pensacola).

Grayish, paler below; fins blackish; pectoral pale; a very faint olivaceous band from the eye to the nape (corresponding to the black band in *S. rivoliana*, but scarcely visible). Body deep, compressed; head compressed, not conical, a little longer than deep; snout  $2\frac{3}{4}$  in head; maxillary reaching front of pupil,  $3\frac{2}{5}$  in head; occiput somewhat carinate; caudal keel little developed. Dorsal falcate, its anterior lobe  $1\frac{2}{5}$  in head,  $2\frac{1}{3}$  in base of fin. Head  $3\frac{4}{5}$ ; depth  $3\frac{2}{5}$ . D. VIII-I, 29; A. II-I, 21. Gulf of Mexico, north to Pensacola.

(Cuv. & Val. ix, 210; Günther, ii, 464; Scriola bonariensis Goode & Bean, Proc. U. S. Nat. Mus. ii, 1879, 129, not of C. & V.? It is thought by Dr. Lütken that this species is identical with S. rivoliana, but this identity is not yet proven. S. rivoliana=bonariensis=bosci seems to be slenderer, with a distinct black temporal band.)

Page 445. Instead of Scriola stearnsi read:

#### 703. S. carolinensis Holbr.

This species differs from *Seriola dorsalis* notably in the larger mouth (maxillary reaching middle of eye,  $2\frac{1}{6}$  in head, in *S. carolinensis*; barely reaching front of pupil,  $2\frac{2}{3}$  in head, in *S. dorsalis*). *S. carolinensis*, *S. lalandi*, and *S. dorsalis* have the occipital region broadly rounded in the adult, while in *S. zonata* it is sharply compressed or carinated at all ages. In *S. zonata*, the body is much deeper, the head more obtuse, and the dark bands in the young fish much blacker.

(Seriola carolinensis and S. zonata Holbrook Ichth. S. Car. 1860, 72; Seriola stearnsi Goode & Benn.)

Page 446. According to Dr. Liitken (Spolia Atlantica, 1880, 603) Elagatis pinnulatus Poey (the "Runner") is identical with Elagatis bipinnulatus (Q. & G.) Benn., a species known from the East Indies and the Mediterranean. References for the latter are:

(Seriola bipinnulata Quoy & Gaimard, Voy. Uran. Zoöl. i, 363: Elagatis bipinnulatus Benn. Whaling Voyage, ii, 283: Seriotichthys bipinnulatus Bleeker, Nat. Tyds. Nederl. Ind. vi, 196: Seriolichthys bipinnulatus Günther, ii, 468; the generic name Elagatis being rejected by Dr. Günther on account of the prior Elacate.)

Page 447. In the typical species of *Scombroides* the maxillary has a small supplemental bone, of which no trace exists in the American species or "*Oligoplites*." The latter group probably merits recognition as

Bull. Nat. Mus. No. 16——58

a distinct genus. In very young specimens of O. occidentalis the upper jaw is protractile as usual in Carangida.

Page 448. Instead of Pomatomus saltator read:

# 708. P. saltatrix (L.) Gill.

"Saltatrix," as used by Linnæus, was an old proper name.

Page 451. Instead of Stromateus alepidotus read:

# 710. S. paru L.

In the description (p. 451) read pectoral much longer than head, and add to the synonymy:

(Stromateus paru L. Syst. Nat. ed. ii, 248; based on a figure and description in Sloane's "Jamaica"): Seserinus xanthurus Quoy & Gaim. Voy. Freye. Zoöl. 384: Rhombus xanthurus C. & V. ix, 405; not Stromateus paru Bloch.)

Page 452. The genus "Mupus" Cocco (Su alcuni nuovi Pesci del Mar di Messina, in Giorn. Scienz. Lett. Arti per la Sicilia, xxvi, No. 77) is, according to Dr. Giglioli (in lit.), probably identical with Lirus; Mupus imperialis Cocco being thought to be the same as Lirus ovalis. As there is some uncertainty, it is probably best, however, not to adopt the name Mupus.

Page 454. Instead of Coryphorna punctulata read:

# 715. C. equisetis L.—Small Dolphin.

Bluish above, paler below, and yellowish; sides immaculate, or sprinkled with small, irregular blue spots; larger spots along base of dorsal; dorsal dark blue, usually marked with wavy lines or rows of spots; anal without spots. Profile of snout not becoming vertical with age; ventrals moderate, inserted somewhat behind the pectorals. D. 51 to 56; A. 24 to 26. Length  $2\frac{1}{2}$  feet. Pelagie; not rare on our South Atlantic and Gulf coast.

(L. Syst. Nat.; Günther, ii, 407; Lütken. Spolia Atlantica, 1880, 483: Lampugus punctulatus C. & V. ix, 327, Coryphana punctulata Günther, ii, 408: Coryphana immaculata Poey, Mem. Cuba, ii, 245; Lowe, Fishes Madeira, 67.)

Page 455. Instead of Coryphana sucuri read:

# 716. C. Mappenns L.—Great Dolphin.

Colors brilliant in life, changing suddenly at death; brownish-olive above, white or golden below, with bright blue spots, the largest on the back and head, forming bands on the snout; dorsal purplish-blue, with paler oblique lines; other fins tinged with blue; caudal yellow; in spirits, pale with blackish spots on the lower parts. Maxillary reaching middle of eye; profile of snout becoming nearly vertical with age; front of anal

under middle of body. "Male with the front elevated, forming a crest, which projects a little beyond the upper jaw; female with blue spots along each side of the tail, regularly arranged." (*Poey.*) Head 5; depth 5. D. 58-64; A. 26-30. Length 6 feet. In all warm seas; common in the Gulf of Mexico.

(L. Syst. Nat.; Günther, ii, 405; Poey, Syn. Pisc. Cub. 356; Coryphana guttata Poey, Mem. Cuba, ii, 245; Lütken, l. c. 483; Coryphana sucari C. & V. ix, 302.)

Page 455. After Pteraclis carolinus add:

#### 236 (b).-BEAMA Bloch & Schneider.

(Bloch & Schneider, Systema Ichthyol. 1801, 99: type Sparus raji Bloch.)

Body compressed, more or less elevated, covered with rather small scales. Mouth very oblique, the lower jaw projecting; both jaws with an outer series of strong teeth; teeth on vomer and palatines deciduous. Dorsal and anal fins elongate, the former with 3 or 4, the latter with 2 or 3 spines; eaudal deeply forked; ventrals thoracic, I, 5. Opercles entire; branchiostegals 7. No air bladder. Pelagic. (Latin brama, bream; the species having been called "Brama marina" by Ray.)

# 717 (b). B. raji (Bloch) Schn.

Coloration uniform. Eye at the middle of the head; pectorals reaching middle of anal. Greatest depth below middle of body, 3 in total length. D. III-31; A. II-27; scales 13-90-23. Pyloric ecca 5. Vertebrae 16 + 23. Atlantic coasts of Europe and Africa, straying to Grand Banks of Newfoundland (Bean), coast of Washington Territory (Bean), and Chili.

(Sparus raji Bloch, Ichth. taf. 273; Günther, ii, 408.)

Page 459. For *Holocentrus* read *Holocentrum*. The former is the original orthography, but it is not worth while to try to restore it.

\* Page 461. Under *Elassomatidæ*, the statements "no teeth on vomer" and "pseudobranchiæ none" are not quite correct. A specimen of *Elassoma zonatum* from Tombigbee River, 1½ inches long, thus much larger than the original types, shows the following characters:

A few weak teeth on vomer; front teeth of both jaws canine-like, directed forward; pseudobranchiæ somewhat glandular, covered by skin. Scales cycloid; no lateral line. Dorsal apparently emarginate. D. V, 9; A. III, 5; Lat. l. 38. Head speckled with black; fins with dark spots.

Page 468. Under Chanobryttus gulosus read: "Head 21; depth 21."

Page 482. Under *Lepomis holbrooki* read: "Head 3"; and under *Lepomis notatus* read: "D. X, 12."

Page 485. Instead of *Micropterus dolomieu*, read *M. dolomiei*. This personal name should have the genitive form.

Page 523. Under *Perca*, tenth line from bottom, add: "Lower limb of preopercle with strong antrorse teeth."

Page 525, tenth line, under *Stizostedium*, add: "Lower limb of preopercle with a few antrorse teeth."

Page 532. After Polyprion oxygenius add:

# 273 (b).—BRACHYRHINUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 236: type Serranus creolus C. & V.)

Body oblong-ovate, compressed; head short, the profile convex, the snout short and blunt; jaws and all the bones of the head covered with imbricated scales. Scales of body very small. Mouth rather small, oblique, the lower jaw projecting. No supplemental maxillary. Teeth as in *Serranus*, but the lateral teeth small, not canine-like. Preopercle evenly serrate. Dorsal spines 9, none of them produced in filaments; tins all low; caudal fin forked. Warm seas.

#### 835 (b). B. furcifer (C. & V.) Poey.

Red or reddish, with three small violet spots on the side of the back and one on the tail; sides with oblique streaks; dorsal fin with a longitudinal blackish streak. Snout short, scarcely longer than the large eye; maxillary reaching to below middle of eye; preopercle finely and evenly serrate. Gill rakers slender. Dorsal spines low, nearly uniform, but longer than the soft rays; second anal spine rather longer than third; pectoral long and pointed, longer than head; caudal deeply forked. Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{5}$ . D. IX, 19; A. III, 9; scales 10-83-85. Tropical America, generally abundant both in the Atlantic and Pacific; recorded by Dekay from near New York. This record is doubtful, although the occurrence of the species within our limits is very probable.

(Serranus furcifer and creolus Cuv. & Val., ii, 264, 265, 1828: Brachyrhinus creolus Gill, Proc. Acad. Nat. Sci. Phila. 1862, 249: Brachyrhinus creolus Poey, Ann. Lyc. Nat. Hist. N. Y. 1871, 46: Corvina oxyptera Dekay, N. Y. Fauna Fish. 1842, 77: Anthias furcifer Gthr. i, 91: Serranus creolus and colonus Gthr. i, 100, 101.)

Page 533. After Serranus atrarius add:

836 (b). S. nigrescens (Bloch & Schn.) Goode & Bean.

According to Dr. Holbrook the northern representative (nigrescens) of Serranus atrarius has the air-bladder simple, and the pectoral as long as the ventral; while in the southern form (atrarius) the air-bladder is sacculated, and the pectoral longer than the ventral. These observations are confirmed by Dr. Bean, who has also noticed other points of difference. The northern form (Cape Hatteras northward) may then stand as S. nigrescens.

(Coryphana nigrescens Bloch & Schneider, 1801, 297: Centropristis nigricans C. & V. iii, 37, and of various authors.)

Page 534. In Serranus trifurcus the filamentous tips to the dorsal spines are often but little developed. A species, apparently the same, occurs in the Gulf of Mexico. Head  $2\frac{\pi}{3}$ ; depth  $3\frac{\pi}{3}$ . D. X, 12; A. III, 7; scales 6-48-13. The section called "Haliperca" should be Prionodes\* Jenyns.

Page 535. To the account of Serranus subligarius add:

A large blotch of cream-color with sharply defined edges in front of vent, extending upwards as an irregular cross-band to near middle of sides; an interrupted black ring around tail at base of caudal; a large black blotch on front of soft dorsal; lower parts of head with a very conspicuous network of bluish streaks; pectorals, anal, and caudal, sharply barred with black; ventrals tipped with black. Body deep, compressed; the head very slender, acuminate, the anterior profile straight or somewhat concave; depth at middle of eye little more than half-length of head; lower jaw little projecting; maxillary reaching posterior margin of pupil,  $2\frac{1}{6}$  in head; canines small, those on sides of lower jaw largest; edge of preopercle sharply and subequally serrate; gill-rakers short. Dorsal little emarginate, the fourth spine 3 in head; caudal subtruncate; second anal spine longer than third,  $2\frac{1}{6}$  in head; jaws, and dorsal and anal fins scaleless. Head  $2\frac{1}{2}$ ; depth 3; D. X, 13; A. III, 7; scales 6-42-17.

Pages 536, 537, etc. All the species of Serranus have normally 10 spines in the dorsal.

Page 536. Instead of subgenus Plectropoma substitute:

#### 274 (b).—HYPOPLECTRUS Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1862, 236: type Pleetropoma puella, C. & V.)

This genus differs from Serranus chiefly in the presence of antrorse

<sup>\*</sup> Prionodes Jenyns, Zoöl. Beagle. Fish. 1842, 46: type Prionodes fasciatus Jenyns.

spines on the lower margin of the preopercle. The species are of small size; the body short and compressed. ( $\delta\pi\omega$ , below;  $\pi\lambda \tilde{\chi} z\tau\rho\omega$ , spur.)

Page 537. Instead of Serranus chlorurus read:

# 843. H. nigricans (Poey) Gill.

The species found on the Florida coast has the body and fins all alike blackish, with violet shades, and is doubtless distinct from H. chlorurus, in which the pectorals and caudal are yellow. Florida to Cuba.

Page 538. Instead of Trisotropis brunneus read:

#### 844. T. stomias Goode & Bean MSS.

The color in this species, the "Black Grouper" of the Florida coast, is dark gray, freekled with paler, but without distinct spots; fins all edged or tipped with black; no yellow nor violet shades anywhere. Caudal lunate. Mouth very large; the maxillary longer than pectoral. The identification of this species with *T. brunneus* Poey is very doubtful. (Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 539. After Trisotropis microlepis add:

# 846 (b). T. petrosus Poey.

Light brownish violet, covered with close-set round reddish brown spots about as large as the pupil, besides large quadrate dark areas on the trunk; no red anywhere. Fins dark brown, except the pectorals, which are black, with a broad border of bright orange, at least in the adult. Maxillary extending beyond orbit. Preopercle rounded, finely serrate. Candal lunate, the lower angle rounded. Head  $3\frac{1}{6}$  (in total); depth 4. D. XI,  $16\frac{1}{7}$  A. III, 11; coca 15 to 20. Cuba to Key West. (*Poey.*)

(Serranus petrosus Poey, Memorias, ii, 136: Trisotropis petrosus Poey, Ann. Lyc. Nat. Hist. N. Y. ix, 301, 1870.)

Page 540. "Epinephelus capreolus" should apparently stand as-

#### 817. E. atlanticus (Lac.) J. & G.

The earlier names, *Holocentrus punctatus* Bloch (Ichth. taf. 241) and *Perca maculata* Bloch are both preoccupied in this genus.

Page 541. After Epinephelus nigritus add:

# 850 (b). E. striatus (Bloch) Gill.—Hamlet; Nassau Grouper.

Chestnut-brown, varying to light slate-color; lips and throat vermillion; a black stripe sometimes present, extending from snout to a point between eyes, then dividing, one branch extending to origin of dorsal, the other to opercle; a large quadrate black blotch on tail behind dorsal;

young with transverse dark bars; ventrals dusky. Body rather deep, somewhat compressed. Month large, the maxillary extending beyond eye, 2 in head; canines rather strong. Preopercle nearly evenly serrate. Candal rounded\*; second anal spine rather strong, slightly longer than third; dorsal spines rather high. Jaws and fins with fine scales. Head  $2\frac{1}{2}$ ; depth  $2\frac{1}{2}$ . D. XI, 17; A. III, 8; Lat. I. about 85. West Indies; north to Key West (*Poey; Stearns*); very abundant; reaches the length of 4 or 5 feet.

(Anthias striatus Bloch, Ichth. ix. 10), 1797; Serranus striatus Günther, i, 110; Goode, Bull. U. S. Nat. Mus. v, 57; Poey, Rep. Fis. Nat. Cuba, ii, 285.)

Page 541. The group called *Bodianus* is probably entitled to generic rank. Its species should stand as follows:

852. B. punctatus (L.) J. & G.

# 852 (b). B. tieniops (C. & V.) J. & G.

Red or dark brown, the head, body, and fins covered with small round blue, black-edged spots; one or two dark-blue streaks from eye to snout; fins all more or less edged with deep blue. Maxillary reaching posterior margin of eye; canine teeth rather strong, the upper largest. Candal rounded behind; no notch between dorsal spines and soft rays. Second and third anal spines about equal. Head  $2\frac{1}{2}$ ; depth  $2\frac{1}{2}$ . D. IX, 15; A. III, 9; Lat. l. 100. Tropical Atlantic; Florida Keys to Senegambia. (Steindachner.)

(Serranus twniops C. & V. ii, 370: Serranus twniops Giinther, i, 121: Serranus twniops Steindachner, Beiträge Kenntn. Fische Afrika's, 1881, 4.)

#### 852 (c). E. guttatus (Gmelin) Goode.—Cabrilla.

Olivaceous; body and head everywhere covered with small bronze spots, much smaller than the pupil, the spots mostly with darker centers; besides these are larger obscure pale spots, around which the ground color forms reticulations; whitish marblings on sides of back; base of pectoral reticulate; vertical fins obscurely spotted; the soft dorsal and caudal broadly margined with black; pectorals pale; ventrals dusky at tip. Body comparatively elongate. Month large, the maxillary extending past the eye, its length  $2\frac{1}{3}$  in head. Eye shorter than snont,  $5\frac{1}{2}$  in head. Depressible teeth in front of jaws long. Fins of moderate height; caudal truncate; anal spines moderate, the second about as long as third, 5 in head; pectoral  $1\frac{3}{3}$  in head. Head  $2\frac{1}{3}$ ; depth

<sup>\*</sup>The candal is limate in E. morio and in the species of Trisotropis. In our other species of Epinephelus it is rounded or truncate.

3. D. XI, 15; A. III, 8; Lat. l. about 100. West Indies, north to . Florida Keys.

(Perca guttata Gmel. Linn. Syst. Nat. i, 1788, 1315: Goode, Bull. v, U. S. Nat. Mus. 1876, 58; Bodianus apua Bloch, taf. 229: Serranus apua Giinther, i, 140: Holocentrus punctatus Bloch, taf. 241: Lutjanus lunulatus Bloch & Schneider, 1801, 329: Serranus catus, lunulatus, arara, and pixanga C. & V. ii, 362, 379, 377, 383: Epinephelus lunulatus Poey, Syn. Pisc. Cubens. 1868, 287: Serranus apua Steindacher, Ichth. Notiz. vi, 43, 1867.)

Page 541. Promicrops should be reunited with Epinephelus. Our species may stand as:

853. E. guasa (Poev) J. & G.

It is however probable, as suggested by Dr. Gill, that the *Epine-phelus guasa* is simply the very old form of *E. nigritus*, also known as "*Guasa*" or "*Warsaw*" by the Florida fishermen.

Page 542. Dules auriga should be omitted, as it has probably never been taken on our coast.

Page 543. Instead of Rhypticus decoratus read:

#### 856. R. migripinmis Gill.

And add to the synonymy:

(Rhypticus nigripinnis Gill, Proc. Acad. Nat. Sci. Phila. 1861, 53: ? Promicropterus decoratus Cope, Proc. Acad. Nat. Sci. Phila. 1870, 113.)

This species inhabits the Pacific coast of Mexico and Central America, and we doubt its occurrence on our Atlantic coast. The specimens obtained by Professor Cope at Newport may belong to some different species.\*

Page 546. Instead of Xenichthys Gill read:

#### 281.—XENISTIUS Jordan & Gilbert (gen. nov.).

In the typical species of *Xenichthys* Gill, the soft dorsal is much longer than the spinous dorsal, and composed of 18 rays; the anal is also similarly elongate, of 16 to 18 rays. In *X. californiensis*, the soft dorsal is shorter than the spinous dorsal, and composed of 11 or 12 rays; the anal is also short. The latter species may be taken as the type of a distinct genus, which may be called *Xenistius*. ( $\xi z z \sigma z$ , peculiar;  $\delta \sigma z \sigma z$ , sail, for dorsal fin.)

<sup>\*</sup>Professor Cope describes the specimen from Newport as follows: "D. II, 26; A. 16; scales 11-98-46, counted from base of second dorsal spine. Dorsal fins connected by membrane as elevated as that of the first dorsal. Head (from premaxilla to end of spine) more than 4 times in length, including caudal fin. Pectorals not narrowed. Eye 5.33 times in length of head. Otherwise, as in P. maculatus Holbr. Color dark brown, covered with round pale spots as large as the orbit, each with a brown central spot. They extend on the dorsal and proximal caudal fins. Second dorsal, anal, and caudal fin broadly blackish-edged."

Page 548. Instead of Lutjanus melanurus read:

# 861. L. chrysurus (Bloch) Vaillant.

Erase from its synonymy "Perca melanura L. Syst. Nat." The latter is a West Indian species of Diabasis (=Hamulon dorsale Poey).

Page 548, 549. In all our species of Lutjanus the series of scales above the lateral line extend obliquely upward and backward, being not throughout parallel with it. In L. chrysurus, caxis, stearnsi, and blackfordi, the patch of vomerine teeth is "anchor-shaped." In many of the other species of the genus the patch of vomerine teeth is lunate, and in some the series of scales above the lateral line are parallel with the lateral line.

Page 549. After Latjanus caxis add:

# 862 (b). L. caballerote (Bloch & Schneider) Poey.

Brown, tinged with violet; red below; fins wine color; eye red; young with a blue stripe or line of points under the eye, but without dark bands. Body rather more elongate than in  $L.\ caxis$ ; snout prominent, 3 in head, the profile somewhat concave; mouth rather small; maxillary not reaching middle of orbit; jaws subequal; teeth very strong; upper jaw with 2 large and 4 small canines; vomerine teeth prolonged backward on the median line; eye  $4\frac{1}{2}$  in head,  $1\frac{2}{3}$  in snout; preopercle notched, but the knob of the interopercle very inconspicuous; caudal emarginate; pectorals  $1\frac{3}{5}$  in head, scarcely reaching front of anal; second anal spine strong, scarcely longer than third; fourth dorsal spine longest. Direction of rows of scales above lateral line very oblique; nuchal scales in 3 series. Head  $2\frac{2}{3}$ ; depth 3. D. X, 13; A. III, 7; scales 9–45–16. West Indies, north to Key West. Reaches a weight of 12 pounds.

(Anthias caballerote Bloch & Schneider, Syst. Ichth. 1801, 310: Mesoprion cynodon Günther, i, 194; Poey, Proc. Acad. Nat. Sci. Phila. 1860, 187; Poey, Synops. Pisc. Cub. 1868, 293; Poey, Ann. Lyc. Nat. Hist. N. Y. x, 75, 1871.)

# 862 (c). L. campechianus Poey.

Deep red, paler on the throat; streaks along the rows of scales bluish above, yellowish on the sides; fins colored like the body; dorsal bordered with orange, and with a narrow blackish edge; caudal bordered with blackish; eye red; a blackish blotch near the lateral line below soft dorsal, as in numerous West Indian species (and in the young of L. blackfordi). Body rather deep. Eye large, 4 in head; maxillary reaching front of eye; preopercle serrate, the concavity slight; interopercle without knob; canines slender; teeth in lower jaw large in

front; tongue with two rough plates; soft dorsal as long as the part of the spinous behind fifth spine; caudal little forked. Temporal band of scales broad; scales above lateral line forming oblique series not parallel with the back. Vomerine teeth prolonged backward in a long band on the median line. D. X, 14; A. HI. 8; 65 scales in a series above lateral line, 53 below. Gulf of Mexico; brought to the Havana markets from the Bay of Campeachy and from Key West. (*Poey.*)

(Mesoprion campechanus Poey, Memorias Cuba ii, 149, 1850, and in Synops. Pisc. Cubens, 294: Mesoprion campechianus Poey, Ann. Lyc. Nat. Hist. N. Y. 1870, 5.)

Page 549. To the account of *Lutjanus stearnsi* add: Scales above lateral line forming oblique series, which are not parallel throughout with the lateral line. Teeth on vomer in an anchor-shaped patch, prolonged backward on the median line; outer pair of canines above, very large; teeth of lower jaw moderate; teeth on tongue in a single patch; maxillary  $2\frac{3}{4}$  in head, reaching front of pupil; posterior nostral ovate; pectoral  $1\frac{1}{2}$  in head; second and third anal spines subequal.

Page 549. After Lutjanus stearnsi add:

# **864** (b). L. synagris (L.) Poey.

Olivaceous above, silvery on sides and below; flushed with reddish above; back and sides with wide, continuous stripes of golden yellow, usually wider than a series of scales; a black blotch below soft dorsal; sides of head with vellow stripes usually continuous with those on sides: two yellow stripes from eye to snout; caudal red; other fins yellowish: dorsal with two reddish longitudinal bands; ventrals margined with white; these colors fading in alcohol. Body rather deep and compressed; anterior profile steep and nearly straight; lower jaw projecting; maxillary reaching to below front of eye. Teeth rather small, subequal, the canines little developed; teeth on vomer in a / shaped patch, slightly prolonged backward on the median line. Scales small, smoothish: those above lateral line arranged in series not parallel with the lateral line. Preoperele with a shallow notch. Dorsal spines slender; anal spines graduated; anal fin rather high: caudal moderately forked. Pectorals long,  $1\frac{1}{2}$  in head, almost reaching anal. Gillrakers rather long and strong. Head  $2\frac{2}{3}$ ; depth  $2\frac{2}{3}$ . D. X, 12; A. III, 7; seales 6-50-17. L. 12 inches. West Indies; north to Key West, Florida.

(Sparus synagris L. Syst. Nat.: Sparus vermicularis Bloch & Schneider, 1801, 275: Mesoprion uninotatus Cuv. & Val. ii, 479: Mesoprion uninotatus Günther, i, 202: Mesoprion uninotatus Poey, Synopsis Pisc. Cubens, 294.)

Page 550. Conodon C. & V. should be recognized as a distinct genus.

Page 550. To the account of Conodon nobilis add:

Series of scales above lateral line, forming series parallel with the lateral line; anterior limb of preoperele with strong spinous teeth directed forwards. In all our species of *Pomadasys* the scales above the lateral line form series not parallel with the lateral line.

Page 551. Pomadasys fasciatus is identical with P. falcomaculatus and should be suppressed. Instead of "Lat. l. 75," in the description of the latter species, read "Lat. l. 57."

Page 551. After bb, etc., add:

c. Body short and deep; the back arched; spines strong; outer teeth enlarged; lips thick; soft dorsal and anal with small scales. (Anisotremus Gill.)

Page 552. In the description of P. virginicus add "scales 10-55-16."

Page 552. Pomadasys bilineatus has been lately taken in Florida by Dr. J. A. Henshall. Scales 6-35-13; about 45 pores in lat. l. The specimens from California referred to this species probably belong to the following:

# 871 (b). P. interruptus (Gill) J. & G.

Adult grayish; each scale on upper anterior part of body with a distinct blackish spot; fins all more or less dusky. Young (?) (interruptus) with the spots obsolete; sides with two parallel jet-black bands, the lower from eye backward nearly but not quite reaching a large black blotch at base of caudal. Back arched; pectoral a little shorter than head; second anal spine robust, half length of head, longer than fourth dorsal spine. Scales very large, especially below spinous dorsal, where they are much larger than in *P. bilineatus*. Head 3; depth 2½. D. XII, 16; A. III, 9; scales 7–34–12; pores about 45. San Diego (?) to Panama.

(? Genytremus interruptus Gill, Proc. Ac. Nat. Sci. Phila. 1861, 256 (young): Pristipoma fürthi Steind. Ichth. Beitr. v, 4, 1876: Pomadasys fürthi Jor. & Gilb. Proc. U. S. Nat. Mus. 1881, 385.)

Page 553. After *Diabasis formosus* add:

### 872 (b). D. elegans (C. & V.) J. & G.

Brownish; sides of head and body with seven or eight conspicuous wavy longitudinal bands of light blue, edged with dusky. Back somewhat elevated; snort long, compressed; mouth large, the maxillary reaching to below eye; eye 1½ in snort, 3½ in body. Head 3½ (in total); depth about the same. D. XII, 16; A. II, 9; scales 8-50-16. West

Indies; north to Florida. Resembles *D. formosus*, but readily distinguished by the striped body.

(Hamulon elegans C. & V. v, 227: Hamulon elegans Günther, i, 306.)

Page 553. After Diabasis chrysopterus add:

873 (b). D. chromis (Brouss.) J. & G.

Light olive; each scale with a large dark spot; these forming very distinct interrupted stripes along the rows of scale; lower fins dusky; a dusky blotch at angle of preoperele. Young with 2 or 3 longitudinal blackish streaks. Back somewhat elevated; maxillary reaching just past front of eye,  $2\frac{3}{3}$  in head. Series of scales above lateral line very oblique (as in all our species of Diabasis), the series from the scapular scale reaching 6th dorsal spine; preopercle well serrated. Longest dorsal spine  $2\frac{1}{2}$  in head; second anal spine strong,  $2\frac{1}{3}$  in head, the fin high. Pectoral  $1\frac{1}{3}$  in head. Head 3; depth  $2\frac{3}{3}$ . D. XII, 18; A. III, 7; Lat. l. 42. West Indies; north to Florida.

(Perca chromis Broussonet MSS: Hamulon chromis C. & V. 242: Hamulon chromis Giinther, i. 310: Hamulon serratum Poey, Memorias, ii, 181.)

873 (c). D. albus (C. & V.) J. & G.

Color pale uniform plumbeous; no black spot behind angle of preopercle. Month wide, but the maxillary not reaching front of orbit; eye 6 in head,  $2\frac{2}{3}$  in snont; preopercle finely and evenly serrate, its posterior limb nearly vertical. Dorsal fin scarcely notched, the spines rather strong, the fourth longest,  $2\frac{1}{3}$  in head; second and third anal spines nearly equal in length and strength, rather more than half fourth dorsal spine. Caudal forked. Head  $3\frac{1}{2}$  (in total); depth  $3\frac{1}{4}$ . D. XII, 16; A. III, 8; scales 7-50-16. West Indies; north to Key West. (*Poey.*)

(Hamulon album Cuv. & Val. v, 241: Hamulon album Günther, i, 311: Hamulon album Poey, Synopsis Pisc. Cubens. 1868, 312.)

Page 553. To description of *Diabasis chrysopterus* add:

Brownish-olive above; a narrow bronze band, darkest in young, from snont, through eye, to base of caudal; above this two or three dark streaks from eye to above gill-opening; another beginning on top of snout on each side, passing above eye, and extending parallel with the first-mentioned stripe straight to last ray of dorsal, where it meets its fellow of the opposite side; a dark streak from tip of snont along me-

dian line to front of anal: very bright specimens show a narrow yellow stripe following each series of scales on back and sides; adults often plain silvery; a large rounded black blotch at base of the caudal: fins all plain; inside of mouth searlet. Body rather elongate, somewhat compressed: the back little elevated. Snort rather short, 23 in head: preorbital moderate, about equaling eye. Maxillary reaching middle of pupil, 2 in head. Eye 4½ in head. Dorsal spines rather high, the longest 13 to 21 in head, longer than the second anal spine; second anal spine strong, longer and stronger than third,  $2\frac{1}{5}$  to  $2\frac{1}{5}$  in head, reaching, when depressed, to base of last ray. Pectorals 11 to 11 in head. Head 3; depth 3. D. XIII, 15; A. III, 8; scales 7-52-13. The color of the young of D. fremebundus is very similar, but the back in the latter species is more arched, the mouth much smaller, and the scales below the lateral line much larger. The adult form of D. fremebundus, as yet unknown, is probably more like D. chromis. To synonomy of D. chrysopterus add:

(Hamulon aurolineatum C. & V. v, 237: Hamulon aurolineatum Gthr. i, 316: Hamulon candimacula Poey, Syn. Pisc. Cub. 379; not of C. & V.: Hamulon quadrilineatum Holbrook, Ichth. S. C. 1860, 195.)

# 874 (b). D. jeniguano (Poey) Goode & Bean.

Pale olive, with faint dusky and yellow longitudinal streaks, especially in the young; fins all pale, probably yellow in life. Body comparatively elongate, compressed, the back little elevated, the profile regularly curved and not steep. Snout 3 in head; eye 3½. Mouth very large, the maxillary extending slightly past middle of eye, 1½ in head. Teeth not very large. Preopercle well serrated. Dorsal deeply notched, the spines moderate, the longest equal to maxillary; soft dorsal low; anal rather high, its edge concave, its second spine about as long as third and much stronger, 2½ in head; caudal well forked, the upper lobe longest. Pectoral 1¼ in head, reaching past ventrals to vent. Scales above lateral line in very oblique series. Head 3; depth 3. D. XIII, 15; A. III, 9; scales 7–50–11. L. 7 inches. Cuba, north to Garden Key, Florida.

(Harmulon jeniguano Poey, Memorias Cuba, ii, 183, 1860, and in Syn. Pisc. Cub. 319; \*Harmulon schranki Agassiz, Spix. Pisc. Bras. 131; \*Harmulon schranki Günther, i, 310.)

Page 556. Before Sparus insert:

#### 285 (b).-CALAMUS Swainson.

(Swainson, Nat. Hist. Fish. etc. ii, 221, 1839: type Pagellus calamus C. & V.)

Body broadly ovate, compressed, the back elevated; head deep; preorbital very deep; eye placed high, preceded by a bluntish pro-

tuberance: posterior postril slit-like, much larger than the roundish anterior nostril; opercles very short and deep; cheeks and opercles scaly, rest of head naked; month low, horizontal, rather small; both jaws with a band of cardiform teeth in front, the anterior series more or less enlarged, sometimes canine-like; sides of each jaw with 2 to 4 series of molars; gill-rakers small. Scales large. Dorsal continuous, rather low, its spines slender; a procumbent spine before the dorsal. concealed by scales in some of the species; caudal deeply forked; anal spines rather small; pectoral rather narrow, usually very long. Second interspinal bone of the anal enlarged, pen-shaped, the end of the air-bladder being received into its concave part. "The skull is extended downwards to the chevron of the vomer, and entire on each side behind the forehead; the parasphenoid has a deep but thin inferior crest, which is more or less notched in front of its posterior decurrent processes; the forehead comparatively narrow, ill-defined, depressed above the preorbital region, horizontally pitted; the occipital crest extending far forwards and thickened with vertical osseous deposits, the inner as well as the outer lateral crests depressed near the orbits." (Gill, MSS.) Species rather numerous, mostly of small size, chiefly of tropical America. (Latin calamus, a pen.)

# 876 (b). C. megacephalus Sw.—Plume-fish; Pez de Pluma.

Light olive, with bluish reflections, the young with dark cross-bars; front of head and preorbital region with horizontal anastomosing wavy lines of steel blue, the interspaces yellowish; ventrals pale. Body compressed, the back arched, the anterior profile steep, not very convex; depth of preorbital half head; preocular prominence not very sharp; eye moderate, 4 in head. Cleft of mouth 3\frac{3}{3} in head. Anterior teeth of each jaw moderately enlarged, 6 to 8 in number; outermost tooth on each side of upper jaw much larger than the others, forming a strong canine directed outward and forward. A concealed procumbent spine before dorsal; dorsal of moderate height, the soft rays highest; caudal deeply forked, the upper lobe the longer; anal spines small, graduated; pectoral reaching front of anal, a little longer than head. Head 3\frac{1}{2}; depth 2\frac{1}{3}. D. XII, 12; A. III, 10; scales 6-55-16. West Indies, north to Florida.

(Pagellus calamus C. & V. vi, 206, 1830: Calamus megacephalus Swainson, Nat. Hist. Fish. ii, 222, 1830: Chrysophrys calamus Günther, i, 187; Poey, Ann. Lyc. Nat. Hist. N. Y. x, 178, 1872: ? Calamus pennatula Gnichenot, Révue des Pagels in Mem. Soc. Imp. Sci. Nat. Cherbourg, xiv, 112, 1868.)

### 876 (c). C. bajonado (Bloch & Schneider) Poey.

Bluish gray, with bright reflections; a blue stripe below eye; angle

of mouth orange; fins pale; young with 5 or 6 dark olive bars; caudal faintly barred. Body deep, the back considerably elevated; muzzle prolonged, the profile somewhat arched; eye large,  $3_3^2$  in head. Canine teeth rather long and strong, all similar, usually about 8 in each jaw outside of the cardiform band. Caudal deeply forked; anal spines graduated; pectoral long, somewhat longer than head, reaching past anal spines. Depth of preorbital  $2_3^4$  in head. Head  $3_3^4$ ; depth 2. D. XII, 12; A. III, 10. Tropical America, north to South Carolina and Lower California.

(Sparus bajonado Bloch & Schneider, Syst. Ichth. 1801, 284: Pagellus caninus Poey, Mem. Cuba, ii, 468, 1861: Calamus bajonado Poey, Ann. Lyc. Hist. N. Y. x, 176, 1872: Sparus brachysomus Lockington Proc. U. S. Nat. Mus. 1880, 283.)

### 876 (d). C. macrops Pocy.

Pale olivaceous, somewhat silvery; sides with obscure olivaceous bands, especially in the young; preorbital not striped; ventrals pale. Body broad-ovate, compressed, the back elevated, the anterior profile slightly curved, not very steep. Preorbital deeper than long, its depth nearly half head. A sharp-edged bony prominence before eye. Eye large, 3 in head, about as long as maxillary. Front teeth slender, little enlarged, about 12 in the outer series in each jaw; molars rather small, in 3 rows above and 2 below. Scales above lateral line, in series parallel with the lateral line. Procumbent spine of dorsal concealed. Fins low; candal moderately forked. Peetoral long, a little longer than head, reaching second anal spine, which is little enlarged, little longer than third. Head 3\frac{3}{3}; depth 2\frac{1}{10}. D. XII, 12; A. III, 11; scales 7-53-17. Cuba, north to Garden Key, Florida.

(Calamus macrops Poey, Ann. Lyc. Nat. Hist. N. Y. x, 181, 1872.)

#### 876 (e). C. arctifrons Goode & Bean.

Light olive, with bright reflections; sides with obscure dark cross-bars; head without distinct markings; fins nearly plain, all pale. Body oblong-ovate, more clongate than usual in this genus, the anterior profile being very convex. Mouth rather large; maxillary  $2\frac{1}{6}$  in head, reaching front of orbit. Front teeth in both jaws rather strong, all similar, somewhat canine-like, 6 to 8 in each jaw; upper molars in 2 rows anteriorly and 3 posteriorly; lower in 2 rows; a conspicuous pore with a dermal flap on each side of snont. Preorbital very deep, its depth  $3\frac{1}{3}$  in head. Eye small,  $3\frac{3}{4}$  in head, placed very high. Dorsal spines slender, the longest  $3\frac{2}{5}$  in head, about equal to longest soft ray. Anal spines small, graduated, the third 4 in head. Caudal deeply

forked, the upper lobe nearly as long as head. Pectorals as long as head, reaching slightly past vent. Head  $3\frac{1}{5}$ ; depth  $2\frac{1}{3}$ . D. XIII, 12; A. III, 11: P. 16: scales 5-46-14. Southern Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

bb. Anterior teeth little larger than the others, not canine-like. (Grammateus Poey.)

# **876** (f). **C. medius** (Poey) J. & G.

Olivaceous, rather dusky; body and vertical fins with obscure bars of dark olive, which mostly disappear with age; preorbital with narrow, horizontal bluish stripes; ventrals pale. Body rather elongate, comparatively elliptical; the back less arched than in other species; the anterior profile moderately curved. Preorbital deep,  $2\frac{1}{3}$  in head; maxillary  $2\frac{1}{3}$  in head. Eye small, placed high, 4 in head. Anterior teeth small, scarcely enlarged, none of them canine-like; molars mostly in three series above, two below. Spines low, slender; soft dorsal low; candal less deeply forked than usual; anal spines graduated; pectoral comparatively short, as long as head, reaching a little past vent. Distance from base of pectoral to base of dorsal less than head. Head  $3\frac{1}{4}$ ; depth  $2\frac{2}{5}$ . D. XII, 12; A. III, 9; scales 5-46-11, 16 in a series between dorsal and nape. L. 10 inches. Florida to Cuba.

(Grammateus medius Poey, Am. Lyc. Nat. Hist. N. Y. 1872, 183.)

# 877. C. milmeri (G. & B.) J. & G.

This species belongs to the genus *Calamus*, and is very closely allied to *C. medius*, from which it may be distinguished by the following characters: No blue stripes on preorbital; ventrals blackish. Back more arched than in *medius*, the anterior profile less convex; distance from axil of pectoral to front of dorsal greater than length of head. Eye 4 in head (not 5 as in *C. microps* Guichenot a Cuban species, with which it agrees in other respects). Scales above lateral line smaller. Scales 6-47-13; about 26 in a series before dorsal. Head  $3\frac{2}{5}$ ; depth  $2\frac{1}{5}$ .

# Page 556. Sparus pagrus L.-Gulf Porgee.

The coloration of this species as shown in specimens from Pensaeola is as follows: Light crimson, shaded with golden olive; sides and below silvery, flushed with red; many scales of back and sides each with a small round spot of deep purplish blue, these forming longitudinal streaks below and broken oblique streaks above lateral line; a few blue spots on nape and operele; fins largely orange, shaded with pink. We find no account of the presence of blue spots in the European variety of this species.

Page 557. The groups called *Stenotomus* and *Lagodon* should be recognized as genera distinct from *Diplodus*, and the prior *Argyrops\** Sw. (Class'n Fish, etc., 1839, 221; type *Sparus spinifer* Forsk.) should probably be used for the former.

Page 557. The species called in the text *Sparus chrysops* and *Sparus aculeatus* are identical. The species belongs to the genus *Argyrops*, and should stand as:

880. A. chrysops (L.) J. & G.—Southern Porgee.

Differing from the common northern scup, A. revsicolor† (Mitch.) J. & G. ( $\equiv S$ . argyrops Auct. not of Linu.), in the following respects:

Body more elongate and less elevated anteriorly; molar teeth coarser; size larger. Head  $3\frac{1}{3}$ ; depth  $2\frac{1}{2}$ . D. XII, 12; A. HI, 11; scales 7-48-14. L. 18 inches. Cape Cod to Florida. The specimen described in the text (25170 U. S. Nat. Mns.) is unusually deep-bodied for this species.

Page 557. After Argyrops versicolor add:

881 (b). A. caprizzus (Bean) J. & G.—Goat's Head Porgee.

Light olive; silvery below; the young with faint very narrow darker bars. Body subovate, the back anteriorly much more elevated than in

"The cranial characters of Argyrops are very different from those of Diplodus, as is shown by the following account of the skulls of the two genera, kindly furnished to us by Professor Gill:

In Diplodus "the skull is extended downwards to the chevron of the vomer, and is notched on each side behind the forchead; the parasphenoid has a varying inferior crest, which is entire near its posterior decurrent processes; forehead broad, well defined, convex transversely above the orbits, abruptly terminated behind by the convergence of the external lateral crests into the occipital, the occipital crest ending abruptly behind the forchead, and thickened with vertical osseous strice; the inner as well as outer lateral crests erect and laminar, and converging more or less forwards.

"In *Diplodus* proper the forchead is moderately broad and the bones contracted forwards, the parasphenoid with a superficial inferior crest, convex forwards, and little developed posterior decurrent processes.

"In Archosargus Gill, the forchead is very broad and the bones wide and almost even with the prefrontals in front; the parasphenoid with a deep inferior crest, and emarginated anteriorly and with enlarged posterior decurrent processes.

"In the genus Stenotomus (Argyrops) the skull is extended forwards to the head of the vomer and notched on each side behind the forehead; the parasphenoid has the inferior crest low, and little developed posteriorly-decurrent processes; the forehead is narrow and ill-defined behind, its surface of compact texture, but with a few foramina and two longitudinal grooves on each side; the occipital crest moderate, extending but little forward of the supracceipital bone, and not overhanging backward; the crest strengthened by a longitudinal lateral ridge on each side, terminating backwards in manifliform projections, the inner and outer lateral crests not procurrent on the forehead."

+ Labrus resistator Mitch., Trans. Lit. and Phil. Soc., 1815, 1, 404. Sparus argyrops L. is the young of A. chrysops, with 2d and 3d dorsal spines filamentous.

rersicolor. Profile steep, with a strong depression above eye; the snout rather pointed; occipital region carinate. Front teeth small, in a close-set band, the outer series a little enlarged, compressed and lance-olate, much as in versicolor. Molars in two rows in each jaw. Gill-rakers very short. A strong procumbent spine before dorsal; first and second dorsal spines very short; third dorsal spine more or less filamentous, reaching past middle of soft dorsal; pectoral a little longer than head, reaching soft rays of anal. Scaly part of cheek as deep as long (in A. versicolor considerably longer than deep). Second interspinal of anal quill-shaped as in Calamus. Head  $3\frac{2}{8}$ ; depth 2. D. XII, 12; A. III, 12; scales about 7-48-14. West coast of Florida, in rather deep water. Distinguished from A. versicolor by the deeper cheek and preorbital, the different form of the body, and the difference in the dorsal spines.

(Stenotomus caprinus Bean, Proc. U. S. Nat. Mus. 1882.)

On page 560, after Diplodus caudimacula, add:

# 885 (b). D. caribæus (Poey) J. & G.—Sargo.

Steel-brown, with golden-yellow longitudinal stripes, which scarcely extend on the head, 3 above, 5 or 6 below the lateral line; a black spot at the shoulder; dorsal yellowish, with a faint dusky median stripe; ventrals orange in the females, yellowish and punctate in the males: anal similarly colored. Body deep; snout obtuse; maxillary reaching beyond posterior nostril; molars in two rows; incisors broad, entire; second anal spine much longer and larger than third; pectoral long and pointed; caudal forked. Head  $4\frac{1}{5}$  (in total); depth  $2\frac{3}{4}$ . D. XIII, 11;  $\Lambda$ . III, 10. West Indies, north to Key West (*Pocy in lit.*).

(Sargus caribaus Poey, Memorias, ii, 1860, 197, and in Synops. Pisc. Cubens. 309.)

Page 563. After Apogon americanus add:

# 889 (b). A. maculatus (Poey) J. & G.

Uniform bright searlet; a round black spot below second dorsal and another on side of caudal peduncle above median line. Maxillary 2 in head, reaching beyond pupil; eye very large, 3 in head; preopercle distinctly serrulate; pectoral  $1\frac{1}{2}$  in head, a little shorter than caudal. Head  $2\frac{1}{4}$ ; depth  $2\frac{4}{5}$ . D. VI-I, 7; A. II, 8; scales  $2\frac{1}{2}$ -26-7. L. 3 inches. West Florida to Cuba.

(Monoprion maculatus Poey, Mem. Cuba ii, 123, 1860; Amia maculata Poey, Syn. Pisc. Cub. 304, 1868; Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 279.)

It is doubtful whether Apogon americanus has ever been really taken

on our coast, or indeed what that species may be. The original type, in bad condition, has been identified by Vaillant & Bocourt with Apogon dovii, a Panama species, and their description, copied in the text on page 563, seems to have been drawn from the latter species.

a. Preopercle entire; scales large. (Apogonichthys Bleeker.)

### 889 (c). A. alutus J. & G.

Rusty-red, with silvery luster, body and fins very finely speckled with dusky; vertical fins somewhat yellow, their tips dusky with dark points. Mouth very oblique; maxillary  $1\frac{1}{4}$  in head, reaching past pupil; preopercle with both ridges entire; eye moderate,  $2\frac{1}{3}$  in head; second anal spine half length of longest anal ray,  $3\frac{1}{2}$  in head; ventrals a little longer than pectorals, not reaching vent. Head  $2\frac{3}{4}$ : depth  $2\frac{3}{4}$ . D. VI-I, 9; A. II, 8; Lat. l. 21. L.  $2\frac{1}{2}$  inches. West Florida.

(?? Apogonichthys puncticulatus Poey, Repert. Fis. Nat. Isl. Cuba, ii, 233 (lat. l. 30); Jor. & Gilb, Proc. U. S. Nat. Mus. 1882, 279.)

# Page 564. Mullus barbatus L.

Specimens of this species have been obtained at Pensacola, Florida, and at Wood's Holl, Massachusetts. The American form (subsp. auratus J. & G.) is distinguishable from the typical barbatus in the lower fins, less blunt snout, shorter mouth, and the presence of two lateral stripes of yellow. From the European variety surmuletus (Mullus surmuletus L.), subsp. auratus is known by the lower fins and by the replacement of the black band on the dorsal fin by a band of yellow. Head  $3\frac{2}{5}$ ; depth 4. D. VII-I. 8; A. II, 6. Palatine teeth coarse and granular, forming a large patch.

(Mullus barbatus auratus Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 280.)

Page 569. Instead of Sciana stellifera read:

#### 895. S. lanceolata (Holbr.) Gthr.

The identity of our species with S. stellifera (trispinosa) is very doubtful.

Page 570. To the description of *Sciuna argyroleuca* (punctata) add "lowest tooth of preoperele spinous, directed downward."

Page 571. Sciena occilata is known as "Red-fish" on our Gulf coast. It reaches a weight of 35 to 40 pounds. Old specimens entirely lose the serratures on the preopercle, the edge of the bone becoming membranaceous and entire as in "Corvina."

Page 572. Instead of "cc," etc., read:

The species of "Sciwna" which have the preopercle without bony serratures may be referred to Corvina. Genus 296 (b), Roncador should probably be retained also.

Page 573. After Corvina acuminata add:

### 293 (2).—EQUES Bloch.

(Bloch Ichthyologia, about 1790: type Eques americanus Bloch.)

Body oblong, compressed, the back much elevated anteriorly. Mouth rather small, the lower jaw included; teeth in villiform bands, the outer somewhat enlarged above; preopercle serrate, the teeth flexible; pseudobranchiæ present. Scales moderate, extending on the soft fins. First dorsal of about 16 spines, the median spines much elevated; second dorsal extremely long. Anal very small; second anal spine small. Pyloric coeca few. Air-bladder simple. Vertebræ 10+15. (Latin, Equus, a horse; the long dorsal spines being compared to a rider.)

# 901 (b). E. lanccolatus (Gmel.) Casteln.

Greyish-yellow, with three broad blackish-brown bands, edged with whitish; the first vertical, from the crown, through the eye to the angle of the mouth; the second slightly arched, from the nape over the opercle to the base of the ventral; the third curved, from the top of the first dorsal along the middle of the side of the body to the middle of the candal fin. Head small; maxillary 3 in head, reaching pupil. Height of first dorsal usually much more than depth of body below it. Head  $3\frac{5}{6}$ ; depth  $3\frac{1}{6}$ . D. XVI-I, 53; A. II, 10; Lat. l. 60. West Indies; lately taken at Pensacola by Silas Stearns.

(Chartodon lanccolatus Gmelin, Syst. Nat. 1788, 1254; Eques balteatus C. & V. v, 165; Günther, ii, 279; Eques americanus Bloch. Ichth. taf. 347, fig. 1.)

Page 575. The synonym "Homoprion xanthurus Holbr." belongs to Sciwna argyrolenca, not to Liostomus xanthurus.

Page 575. Genyonemus. Several of the characters given in the text are inapplicable to South Δ merican species now referred to Genyonemus.

\*Cuvier, Règne Animal, ed. 2. ii, 173, 1829: type Sciana nigra Bloch = Sciana umbra L. in part, the species having been confounded by L. with Sciana umbra (=aquila Lac.). The enlargement of the second anal spine, used by Cuvier to distinguish Corrina from Sciana, has no taxonomic value. (Corrina, the Italian and Spanish name for various Scianoids, originally from Latin Corvus, crow, in allusion to the dusky color of C. nigra.)

Some of these have the mouth subinferior, the barbels conspicuous, forming a tuft at the chin; the dorsal spines 10 and the candal double-truncate; the gill-rakers short. The diagnosis should be amended accordingly.

Page 570. Instead of Sciana punctata read:

#### 896. S. chrysura (Lac.) J. & G.

(Dipterodon chrysurus Lacépède iii, 64, 1802.)

There are two species called *Perca punctata* in the Systema Naturae, and the second of these should be suppressed.

Page 577. Instead of the account of *Menticirrus littoralis* substitute: 908. M. littoralis (Holbr.) Gill.—Surf Whiting.

Grayish silvery, nearly plain, without traces of bars; pectorals, ventrals, and anal pale, with a few black dots; caudal tipped with blackish; lining of opercle pale. Body rather elongate, the candal peduncle very slender; snout bluntish, 3 in head, projecting beyond premaxillary for about one-sixth its length; maxillary reaching about to front of eye; posterior nostril lanceolate; outer teeth little enlarged, very much smaller than in M. alburnus. Gill-rakers small, but developed; lower lobe of caudal longest. Scales on breast very small, irregular. Head  $3\frac{1}{6}$ ; depth  $4\frac{2}{5}$ . D. X-1, 23; A. I, 7; scales, 6-50-11. South Atlantic and Gulf coast. M. undulatus is closely related to this species.

M. alburuus is darker in color, usually with traces of dusky bars; pectorals blackish; lining of opercle black. Snout sharp,  $3\frac{3}{5}$  in head; snout much projecting (one-third its length). Outer teeth of upper jaw very large; posterior nostril ovate; gill-rakers tubercular, almost obsolete; maxillary about reaching middle of eye. Scales on breast large, regularly placed. Head  $3\frac{1}{2}$ ; depth  $4\frac{1}{4}$ . D. X-1, 24; A. I, 7; scales 6-54-11.

Page 578. Menticirrus undulatus has the outer teeth of the upper jaw not greatly enlarged and should have been placed rather under a instead of aa. Umbrina elongata Othr., from the Pacific coast of tropical America, is a different species. The latter name should be erased from the synonymy of M. undulatus.

Page 578. The teeth in *Larimus* are mostly in single series. The genus "*Monosira*" Poey (Anal. Soc. Esp. Hist. Nat., x, 326, 1881), is identical with *Larimus*.

Page 579. The genus Atractoscion should be suppressed. Our species may stand as 912, Cynoscion nobile (Ayres) J. & G.

Page 581. The presence of one or two anal spines in Cynoscion has no importance. Probably a rudiment of the first spine will be found in all the species. Cynoscion regale and Cynoscion nothum are distinguished from our other species by having the second dorsal and anal covered with small scales; these fins being naked in the other species. Otolithus drummondi Rich. (Fauna Bor.-Amer. iii, 1836, 70; Günther, ii. 307), from New Orleans, is identical with Cynoscion maculatum. This species has the candal unevenly truncate, not "Innate", as stated in the text.

Page 583. After Gerres plumieri add:

#### 919 (b). G. olisthostoma Goode & Bean.—Irish Pompano.

Color silvery olivaceous; seales with faint silvery streaks but no dark ones; fins mostly pale or yellowish, the ventrals somewhat dusky. Body rhomboid, short and deep, the back elevated, the anterior profile straight and very steep; month rather large; teeth slender, brush-like. Preorbital entire; preopercle and interopercle serrate. Groove on top of head, for reception of premaxillaries, broad, rounded behind, with a median linear depression, its surface completely covered with small deciduous scales, which extend forward to just behind nostrils. Eye moderate. Dorsal spines high and strong, the second, nearly or quite as long as head. Second anal spine very strong, half or more length of head. Caudal lobes long and slender, a little longer than head. Pectoral long, nearly as long as head, reaching front of anal. Head 3; depth 2. D. IX, 10; A. III, 8; scales 5–37–9. L. 12 inches. West Indies, north to Southern Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 423; Gerres rhombeus Poey, Syn. Pisc. Cub. 1858, 32; Mojarra rhombea Poey, Anal. Soc. Esp. Hist. Nat. x, 327, 1881, not Gerres rhombeus C. & V. vi, 459; a species of similar form, but with two anal spines only, and the premaxillary groove entirely naked. The genus Mojarra, in Pocy's arrangement, is distinguished from Gerres by the entire preorbital, and from "Diapterus" by the serrated preopercle.)

Page 584. Instead of Gerres argenteus read:

#### 920. G. gula C. & V.

This species is distinguished from the other American species (except Gerres homonymus) by the presence of a transverse band of scales across the anterior part of the groove of the premaxillaries on the top of the head; behind these scales the naked part of the groove appears as a pit when the jaw is protruded. Third dorsal spine  $\frac{2}{3}$  as long as head, twice as long as second anal spine. Head  $3\frac{1}{4}$ ; depth  $2\frac{2}{3}$ . D. 1X, 10; A. III, 7; scales 4-45-9. Tip of dorsal dusky. West Indies, north to Cape Cod.

To the synonymy of this species add:

(Gerresgula C. & V. vi, 464; Günther, i, 346, and iv, 255: Diapterusgula Poey, Synopsis Pise, Cubens, 323, is a different species. The types of Eucinostomus argenteus B. & G. from New Jersey, are too young to be certainly identified. Numerous specimens collected by us in North and South Carolina belong to Gerres gula.)

# Page 584. After Gerres homonymus read:

# 921 (b). G. cimereus (Walb.) J. & G.

Silvery; back and sides with 6 to 8 bluish vertical bars, about as broad as the pupil, these extending to opposite lower part of orbit; the bars formed of confluent blotches and rarely obsolete; axil dark; fins with some dark points. Body rather elongate, the back somewhat elevated and compressed, the belly nearly straight, with an angle at the breast. Teeth very small; preorbital and preopercle entire; furrow on top of head for premaxillary processes broad, scaleless, rounded behind. Dorsal spines slender, flexible, the longest  $\frac{2}{3}$  head, half longer than second anal spine. Pectoral slender, rather longer than head. Caudal deeply forked, a little longer than head. Head  $3\frac{1}{5}$ ; depth  $2\frac{2}{5}$ . D. IX, 10; A. HI, 7; scales 5–40–10. L. 18 inches. The largest of our species of the genus. West Indies and both coasts of Mexico; north to Florida Keys and Gulf of California.

(Mugil cinercus Walbaum, Artedi Piscium 1792, 223 (after Tardus cinercus peltatus Catesby): Gerres aprion C. & V. vi, 461, 1830 (not of Günther): Diapterus aprion Poey, Syn. Pisc. Cub. 1868, 321: Gerres zebra Müller & Troschel, Schomburgk Hist. Barbadoes, 1848, 668: Gerres zebra Günther, i, 343 and iv, 254: Gerres squamipinnis Günther, i, 349 and iv, 254.)

The species of *Gerres* here noticed may be readily separated by the following analysis:

- a. Preopercie serrate; anal rays III, 8; second anal, and third dorsal spines long: body elevated. (Gerres.)
- aa. Preopercle entire; anal rays III, 7; dorsal and anal spines comparatively low; body little elevated. (Diapterus Ranzani.)
  - c. Premaxillary groove scaled in front, with a naked pit behind.
    - d. Depth about half length; third dorsal spine little longer than second anal.

Homonymus.

- dd. Depth about  $\frac{5}{8}$  length; third dorsal spine about twice length of second anal......GULA.
- cc. Premaxillary groove entirely naked,

The character of "lower pharyngeals united" has little importance in this group. In *Gerres plumieri*, as in nearly all the species examined by us, the bones are not at all co-ossified, although very close together.

Page 586. "Ditrema violaceum" Hutton, from New Zealand, is a Scombroid fish, and not an Embiotocoid.

Page 590. The genus *Holconotus* Agassiz should be recognized for those species of *Amphistichus* which have the lower lip without frenum, and *Brachyistius* Gill for those of *Micrometrus*, which have the frenum. No. 930 should stand as—

930. II. argentens (Gibbons) J. & G.

Page 600. Instead of Tautoga read:

#### 316.—HIATULA Lacépède.

(Lacépède, Hist. Nat. Poiss. ii, 523, 1800; type Labrus hiatula L.=Hiatula gardeni Lac.) (Latin, hiatus, a gap.)

Instead of Tantoga onitis read:

942. II. onitis (L.) J. & G.

Page 600. Add to the synonymy of *H. onitis*—

(Labrus hiatula L. Syst. Nat.: Labrus hiatula Gmelin, Syst. Nat. 1287, 1788: Hiatula gardeniana Lacépede, Hist. Nat. Poiss. ii., 523, 1800; the genus and species, based on a specimen of Tantog which had in some way lost the anal fin; this specimen seems to have been sent from Charleston by Dr. Garden to Linnieus. If Micropterus and other generic names, based on abnormal or mutilated specimens, be adopted, we must substitute Hiatula for Tantoga.)

Page 602. Instead of aa, etc., read:

#### 318 (b).—TROCHOCOPUS Günther.

(Günther, Cat. Fish, Brit. Mus. iv. 100, 1862: type Trochocopus opercularis Gthr.)

This group is distinguished from Harpe by the smaller scales (Lat. 1, 45 to 65), which scarcely encroach on the bases of the soft dorsal and anal. In the present classification of the Labridæ, this group may be recognized as a distinct genus, although differing from Harpe in no respect of importance. Species few.  $(\tau\rho\sigma\chi\sigma\tau_{\tau}, a \text{ running}; z\omega\pi\eta_{\tau}, aar.)$ 

945. T. pulcher (Ayres) Garman.

Page 603. For *Platyglossus grandisquamis* and *P. humeralis* read: **947** (**948**). **P. bivittatus** (Bloch) Gthr.

This species seems to be widely distributed, and varies considerably with age and sex. The following is a description of the young ("florealis"), supposed by us at first to belong to a different species:

Olive-brown; a greenish stripe along side of back; a dark-brown lateral band from gill-opening to middle of caudal, on level of eye; a

dark-bronze stripe from pectoral backward; each scale of sides with a greenish-blue crescent; sides of head orange; a blue wavy stripe below eye, turning downward on subopercle; opercle with an indigo spot. bordered by bluish and yellow; tip of opercle yellow, the color bounded by a blue <-shaped line; lower jaw with bands of orange and whitish: a small inky spot at base of last ray of soft dorsal; dorsal cherry-red, with translucent bands; eardal reddish; anal banded with red and pale; pectorals yellowish; ventrals white. Body slender; shout not very sharp; posterior canine small. Dorsal spines low, stiff and pungent; caudal short, obliquely truncate. Head 31; depth 4 (43 in total). D. 1X, 11; A. HI, 12; scales 13-26-8. L. 33 inches. Pensacola Bay. Old specimens, (Charleston, S. C.) are deeper-bodied and have the posterior part of the candal, especially the angles, black or dark-blue. the basal part of the fin with concentric, convex, broad streaks of orange, with narrower bluish interspaces; the dorsal is largely orange, with a median blackish or brown band, which is often obsolete, its base with crimson spots; anal with a crimson band and some bluish streaks.

# To the synonymy add:

North Carolina to Surinam.

(Labrus birittaius Bloch, Ichthyol, taf. 284, f. 1; Julis psittaeulus C. & V. xiii, 387; Günther, iv. 161; Steindachner, Ichthyol, Notiz. vi, 49, 1867; Platyglossus florealis Jon. & Girb, Proc. U. S. Nat. Mus. 1882, 287; Platyglossus grandisquamis and humeralis, this work, p. 603.)

Black spot at base of last dorsal ray disappearing with age. Females with the dark lateral band less distinct, the colors duller, the dark dorsal band more distinct than in the males. Head  $3\frac{1}{3}$ ; depth 3, in

# 948 (b). P. cattenis (Poey) Gthr.

Olivaceous; a row of sky-blue spots on each side of back; a broad area of orange, intermingled with violet spots, extending along sides, most conspicuous anteriorly; below this a band of pale violet, becoming posteriorly spots of deep violet; still lower a deep yellow band bounding the white of the belly; preorbital and suborbital scarlet, with 3 blue stripes, marked with cherry-red; cheeks below yellowish; opercles bright red, with 3 oblique violet stripes, the upper forming behind eye an oblique blotch, in the middle of which is a round ink-like spot; no opercular spot; dorsal orange, the soft part with 3 rows of violet spots; candal orange and blue, the former color arranged in 1 longitudinal, 2 marginal, and 2 converging bands, which are joined by reticulations around bluish spots; anal with a basal row of orange spots, then blue spots, then a yellow band, then blue, then finally edged with

orange; ventrals red; pectorals mostly violet; spots on head and posterior parts bright clear blue, elsewhere duller and violaccous. Body very slender, the snout pointed; posterior canine large. Dorsal spines slender, but pungent; candal convex, its corners slightly produced. Head 34; depth 44 (5 in total). D. IX, 11; A. III, 12; scales 2-25-6. Pensacola, Florida, to Cuba and Surinam (here described from young males).

(? Julis caudalis Poey, Mem. Cuba, ii, 213; ? Günther, iv, 166; Jordan & Gilbert, Proc. U. S. Nat. Mns. 1882, 286; ? Julis pictus Poey, Mem. Cuba, ii, 214; ? Platyglossus pictus Günther, iv, 166; ? Platyglossus poeni Steind. Ichth. Notiz, vi, 49, 1867.)

Page 606. Instead of Hemistoma substitute—

# 323.-SCARUS Forskal.

(Forskål, Fanna Arabica, 1775, 25; type Scarus psittacus Forskål,)

Omit from the description of the genus the following clauses: "Lateral line continuous." "Lower jaw included. Scales on the cheek in more than one series." "Dorsal spines flexible." Our species should stand as—

#### 954. S. guacamaia C. & V.

Page 607. After Scarus quacamaia add:

### 954 (b). S. croicensis Bloch.-Bullon.

Bluish silvery, with three red longitudinal bands; the upper from the nape to the end of the dorsal; the second through the eye, crossing the space between the two portions of the lateral line; the third from the base of the pectoral to the lower half of the candal fin; head mostly rosy; snout with bright-colored streaks; fins all yellow. Three series of scales on the cheek; the middle composed of five scales; the lower of three, and covering the limb of the preopercle. Caudal subtruncate. Teeth small, whitish or rosy; no posterior canine. Upper lip broad, covering more than half of upper jaw. Dorsal spines flexible. Head  $3\frac{1}{2}$  in total length; depth  $3\frac{2}{3}$ . D. IX, 10; A. 11, 8; Lat. 1. 24. L. 7–8 inches. (Cuv. & Val.) West Indies, north to Southern Florida (Bean).

(Bloch, Ichth. 1797, 18, pl. 121: Scarus insulw-sanctw-crucis Bloch, & Schn. 1801, 285: Scarus alternans C. & V. xiv, 200: Pseudoscarus sanctw-crucis Günther, iv, 226.)

bb. Dorsal spines pungent; scales on check in one series. (Sparisoma\* Sw.)

#### 954 (c). S. squalidus Poey.—Vicja Muger.

Rosy olive; a black blotch on the upper half of base of pectoral; front of head with brownish reticulations; fins rosy; color in

<sup>\*</sup> Swainson, Class. Fishes, ii, 227, 1829: type Sparus abildgaardii Bloch. (= Scarus Blecker, not of Forskâl, which is Hemistoma Sw. or Pseudoscarus Blecker.)

spirits nearly plain; faint whitish streaks along the rows of scales on the sides. Teeth rather distinct; caudal emarginate, the outer angles produced; cheeks with about three scales. Head 34; depth 3. West Indies, north to Garden Key, Florida.

(Pocy, Mem. Cuba, ii, 218, 1860; Poey, Syn. Pisc. Cub. 338.)

### 954 (d). S. radians C. & V.—Spanish Porgy.

Reddish olive; lower parts and anal rose-colored; dorsal fin and upper parts marbled with brownish; eaudal with irregular dark crossbands, including whitish spots, and with a narrow whitish edge; anal with four oblique dark spots; root of the pectoral blackish; a light band across chin. Snout not twice length of eye. Caudal truncate, the outer rays slightly produced in the adult, rounded in young. Teeth very distinct; young with pointed teeth directed outward around the jaw. Four scales on cheek. L. 8 inches. (Günther). Florida to Brazil.

(Cuv. & Val. xiv, 206; Günther iv, 211; Goode, Bull. U. S. Nat. Mus. v, 32.)

Page 608. After Heros cyanoguttatus add:

#### 955 (b). M. pavonaceus Garman.

Dark brown, flecked with pale; 4 to 6 ocellated, vertically-expanded black spots on side below dorsal fin; an ocellated black spot on base of tail above lateral line; side with 10 or 12 faint dark cross-bands. Head as deep as long. Eye large, wider than preorbital, its front behind tip of maxillary; 5 rows of scales on cheek. Fifth dorsal spine highest; soft dorsal and anal reaching caudal; pectorals to vent. Head  $2\frac{2}{3}$ ; depth  $2\frac{2}{3}$ . D. XVI, 12; A. V, 8; scales 4–32–12. Monclova, Coahuila. (Garman.)

(Garman, Bull. Mus. Comp. Zool. 1881, 93.)

Page 610. It is probably better to recognize the genus 325 (b), Gly-phidodon Lac., distinguished from Pomacentrus by its notched teeth. Our species may stand as—

#### 958. G. declivifrons (Gill) Gthr.

(Euschistodus acclirifrons and E. concolor Gill, Proc. Ac. Nat. Sci. Phila. 1862, 37: Euschistodus analogus Gill, Proc. Ac. Nat. Sci. Phila. 1863, 220; Günther, iv, 38.)

# 959. G. saxatilis (L.) Lac.

Page 611. Chromis punctipinais belongs to the subgenus Furcaria Poey (Memorias Cuba, ii, 195; type Furcaria puncta Poey Ayresia Cooper), distinguished from Chromis proper by the more clongate body, the more deeply forked caudal, and by the presence of 12 dorsal spines.

Page 612. After Chromis insolatus add:

# 961 (b). C. enchrysurus J. & G.

Dusky bluish; a blue stripe from tip of snout through upper part of eye to above lateral line; caudal deep yellow; pectorals, most of soft dorsal, and distal half of anal, light yellow; fins otherwise dusky; a small black spot in axil. Body regularly ovate-oblong. Jaws equal, the maxillary  $3\frac{1}{5}$  in head, extending a little past eye; preopercle with blunt serrations. Teeth slender, conical, in a moderate band. Dorsal emarginate, the longest spine  $1\frac{1}{2}$  in head; caudal lunate; second anal spine  $1\frac{1}{3}$  in head. Head  $3\frac{1}{3}$ ; depth 2. D. XIII, 12; A. II, 12; scales 3-26-9. Pensacola, Fla.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 286.)

Page 615. After Chatodon maculocinetus add:

#### 963 (b). C. Dimaculatus Bloch.-Four-eyed Fish; White Angel,

Pearly gray; snout, edge of opercle, base of pectoral, anal, caudal, and dorsal bright yellow; a black band, edged with yellow, extending from a point in front of and below first dorsal spine across eye to margin of interopercle; soft dorsal with a large, round, indistinct black spot at its base, between fifth and twelfth rays, and a small, deep black spot at its angle; soft dorsal with a narrow marginal line of black; soft anal with a narrow submarginal band of light blue, edged anteriorly with black; caudal with a terminal band of bluish, the center bright yellow; base of ventrals blotched with yellow. Snout produced, longer than eye; preopercle finely denticulated. Soft dorsal and anal angular behind. D. XII, 20; A. III, 16; scales 6–34–15. (Goode; Günther.) West Indies, north to Key West (Stearus).

(Bloch, Ichth. vii, 1797, taf. 219; Günther, ii, 9; Poey, Memorias, ii, 371, 1861: Sarothrodus bimaculatus Goode, Bull. U. S. Nat. Mus. v, 43.)

# 963 (c). C. capistratus L.

A black, white-edged, ocular band, much narrower than the eye, extending over the interopercle, not over the chest: a round, black, white-edged spot immediately before the angle made by the dorsal fin and the back of the tail; blackish oblique streaks along the series of scales: those of the upper half of the body descending forwards; those of the lower ascending forwards; a grayish band, edged with black, across the middle of candal, continued on the soft dorsal and anal fins, where it runs parallel with the margin and near it; ventrals whitish. Shout very slightly produced, nearly as long as eye; preopercle very faintly

serrate. Soft dorsal and anal angular behind. D. XIII, 19; A. III, 17; scales 6-42-17. (*Günther.*) West Indies, north to Florida Keys. (L. Syst. Nat.: Günther. ii. 12.)

Page 615. After Pomacanthus ciliaris add:

### 964 (b). P. tricolor (Bloch) J. & G.—Black Angel.

Head, caudal fin, anterior part of trunk, and margins of soft dorsal and anal yellow; rest of body black. Preopercular spine grooved, reaching to posterior margin of opercle. Soft dorsal, anal, and upper ray of caudal, moderately produced. D. XIV, 19; A. III, 18; scales 8-48-25. (Günther.) West Indies, north to Florida Keys.

(Charlodon tricolor Bloch, Ichth. xii, 1797, taf. 425: Holacanthus tricolor C. & V. vii, 162: Holacanthus tricolor Günther, ii, 49.)

Page 617. After Acanthurus chirurgus add:

# 966 (b). A nigricans (L.) Bloch.

Closely related to Acauthurus chirurgus, differing in the longer snont, which is more convex in its upper portion. Caudal triangular, scarcely concave behind; vertical bands on the side very narrow, usually disappearing after death; fins without oblique stripes. (*Pocy.*) West Indies, occasionally northward (said to have been once taken at New York).

(Chartodon nigricans Linn, Syst. Nat.: Acauthurus phlebotomus Cuv. & Val. x, 176, tab. 287, 1835; Acauthurus phlebotomus Poey, Anal. Soc. Esp. Hist. Nat. 1880, 245.)

### 966 (c). A. tractus Poey.

Distinguished most readily by the length of the caudal lobes, especially the upper, which is notably longer than the lower, its tip ending in a whitish thread; anterior profile moderately curved. Dorsal with faint oblique streaks. Body usually without dark streaks. West Indies and both coasts of Mexico, occasional northward.

(Acanthurus chirurgus C. & V. x, 168 (not Chatodon chirurgus Bloch); Poey, Mem. Cuba, ii, 208, 1860; Poey, Anal. Soc. Esp. Hist. Nat. 1880, 246.)

Page 628. Astroscopus y-gracum and A. anoplus are very closely related. The following distinctive characters may be found useful:

In A. anoplus the pale spots are much smaller, less sharply defined, and occupy a smaller area than in A. y-græcum; the lower part of head has two black blotches in both species; the second dorsal, anal, and ventrals are nearly or quite plain. The naked area behind each eye is, in A. anoplus, lunate, its length barely twice that of the snout; the bony V-shaped plate is short and broad, coneave on the median line, and forked for about half its length, the posterior undivided portion broader

than long; the bony bridge across the occiput but little shorter than the part of the head which precedes it. In *A. y-gracum* the naked area is trapezoidal, longer than broad, and about 4 times the length of the snont: the **Y** is forked for more than half its length, its undivided part more than twice as long as broad, and not concave; the occipital plate is not half as long as the part of the head which precedes it.

Page 629. After Astroscopus anoplus add:

# Family CIII (b) —OPISTHOGNATHIDÆ.

Body oblong or elongate, low, moderately compressed, covered with small, cycloid scales. Lateral line present, usually incomplete, straight. running close to the dorsal fin. Head large, naked, the anterior profile decurved. Month terminal, horizontal, its cleft usually very wide, the maxillary extending past the eye, and sometimes considerably beyond the head; supplemental maxillary present; premaxillaries protractile; jaws subequal, with conical or cardiform teeth: vomer usually with a few teeth: palatines toothless: opercles unarmed; no suborbital stay. Pseudobranchiæ present. Gill-rakers rather long; gills 4, a slit behind the fourth; gill-membranes united, free from the isthmus. Branchiostegals 6. Air-bladder present. No pyloric cœca. Dorsal fin long, continuous, its anterior half composed of slender, flexible spines; caudal distinct, rounded or lanceolate; tail diphycercal; anal long, without distinct spines; ventrals separate, jugular, I, 5, the middle rays longest; pectorals fan-shaped. Two genera, of about 12 species, inhabiting rocky bottoms in tropical seas. Their relationships are apparently with Trachinoid forms, but they bear considerable resemblance to the Clinoid Blennies. (Trachinidae, genus Opisthognathus Günther, ii, 254-256.)

Opisthognathus, 328 (e).

# 338 (b).—GNATHYPOPS Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1862, 241: type Opisthognathus maxillosus Poey.)

This genus includes those *Opisthognathidæ* in which the maxillary is of medium length and truncate behind. ( $\gamma \nu \acute{a}\theta \sigma 5$ , jaw;  $\delta \pi \omega$ , below;  $\dot{\omega} \varphi$ , eye.

# 977 (b). G. maxillosus (Poey) Gill.

Color grayish olive, with 7 irregular A-shaped bars of darker, everywhere much marbled and variegated; fins all similarly marked, the

ventrals dusky, the dorsal with a dusky blotch in front. Body moderately compressed; head not very large; maxillary truncate behind, extending behind eye for a distance about  $\frac{2}{3}$  diameter of eye, its length  $1\frac{2}{3}$  in head; eye  $\mathbb{S}^2_3$  in head. Teeth conical, curved, well separated, mostly in a single series. No teeth on vomer. Fins moderate; dorsal continuous, its spines slender; candal short, its length  $\frac{2}{3}$  head. Head  $3\frac{5}{6}$ ; depth  $4\frac{1}{3}$ . D. VIII, 17; A. II. 13; Lat. l. 65. Cuba, north to Garden Key, Florida.

(Opisthognathus maxillosus Poey, Mem. Cuba, ii, 286, 1860; Poey, Syu. Pisc. Cub. 400.)

# 338 (e).-OPISTHOGNATHUS Cuvier.

(Cuvier, Règne Anim. ed. 2, 1829: type Opisthognathus sonneratii Cuv.)

Maxillary prolonged backward in a long, flexible lamina, which sometimes reaches base of pectoral. Characters of the genus otherwise included above. ( $\delta\pi\iota\sigma\theta\eta$ , behind:  $\gamma\nu\dot{\alpha}\theta\sigma_{5}$ , jaw.)

### 977 (e). O. scaphiurus Goode & Bean.

Grayish olive, much variegated with whitish and dark olive; about 6 irregular dusky bands on the body, which extend on the dorsal fin: whitish markings on body forming roundish spots, surrounded by reticulations of grayish olive; head marbled, its posterior part, as well as the sides of the back and pectoral base, with small blackish dots; membrane lining the inside of the maxillary with 2 curved inkyblack bands on a white ground; angle of mouth with a black spot: lining of opercle black; fins all variegated like the body. Body moderately elongate, somewhat compressed. Head blunt anteriorly: snout very short, about as long as pupil; eye large, 4 in head; maxillary reaching slightly past edge of preopercle, but not to end of head, its length contained  $3\frac{3}{4}$  times in length of body. Teeth rather strong, wideset, forming 2 distinct series, directed backward, especially in the upper jaw; lateral teeth of lower jaw largest; a single vomerine tooth. Gillrakers long and slender, nearly 20 below angle. Scales very small, Dorsal fin low, continuous, the soft rays but little higher than the spines, which are slender and tlexible, the longest 33 in head. Candal short, rounded, its length  $5\frac{3}{5}$  in body. Anal similar to soft dorsal. Pectoral half as long as head. Depth 5. D. XI, 16; A. 18; P. 17; Lat. l. 109. Florida Keys.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 417.)

#### 977 (d). O. lonchurus J. & G.

Olivaceous; margin of upper lip with a narrow black stripe; caudal with 3 dusky bars; color of rest of body nearly uniform. Head not very

large; snout very short, shorter than pupil; eye  $3\frac{1}{3}$  in head; maxillary  $1\frac{1}{3}$  in head, rather narrow; lower jaw included; vomer with 5 rather large teeth. Longest dorsal spine about as long as head, slightly higher than soft rays; candal long, the middle rays scarcely shorter than head; longest anal rays  $1\frac{1}{5}$  in head; pectoral little more than half head. Scales moderate. Head  $3\frac{1}{3}$ ; depth  $4\frac{3}{5}$ . D. 25; A. 15; Lat. l. 67. Two specimens known, taken from the stomach of a Red Snapper at Pensacola, Fla.

(Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 290.)

Page 630. In key, under jj, after the word "series," add "in lower jaw."

Page 632. Dormitator lineatus is apparently identical with D. maculatus, and may be suppressed. The genus Dormitator is best distinguished from Electris by the numerous long, lamelliform appendages of the narrow lower pharyngeal bones. In Philypuus, Culius, and Electris the bones are broader, and without appendages.

#### 341 (b).—CULIUS Bleeker.

(Bleeker, Boeroe, 411: type Eleotris niger Q. & G. = Pacilia fusca Bl. & Schn.

This genus is distinguished from *Electris* by the presence of a stout hook-like spine, directed downwards and forwards, near the angle of the preopercle. Gill-openings extended forwards. Teeth fixed. Species rather numerous in brackish and fresh waters of tropical regions. (Name of Indian origin.)

#### 981 (b). C. amblyopsis Cope.

Dull olivaceous; everywhere dusted with dark points; finely barred with paler; a black streak from eye to upper edge of gill-opening; a blackish spot above base of pectoral. Form of *Eleotris gyrinus*. Maxillary reaching middle of eye,  $2\frac{3}{4}$  in head; teeth of the inner series in each jaw largest. Scales larger than in other species of the genus. Head  $3\frac{2}{5}$ ; depth  $5\frac{3}{4}$ . D. VI, 9; A. 8; Lat. l. 48. South Carolina to West Florida and Surinam.

(Cope, Trans. Am. Philos. Soc. Phila. 1870, 473.)

Page 632. Gobius catulus Grd. proves to be a true Gobius, and is identical with Gobius soporator. It should, therefore, be erased. The upper rays of the pectoral are silk-like. Head  $3\frac{1}{3}$ ; depth  $4\frac{1}{6}$ . D. VI-10; A. I, 9; Lat. l. 33 to 38; 12 rows between dorsal and anal. It is very abundant about rocks and ballast heaps from Florida to Texas.

Professor Gill informs us that one of the species of *Gobius* described by Girard from Texas is, however, undoubtedly a true *Evorthodus*. As all of these species, except *G. würdemanni*, have now been accounted for, the latter species may be provisionally referred to *Evorthodus*.

Page 633. No. 983, Euctenogobius lyricus is a marine species, found along the coast of Texas. The genus Euctenogobius intergrades with Gobius and can hardly be retained.

Page 633. After Gobius lyricus add:

#### 983 (b). G. encæomus J. & G.

3 olivaceous, mottled with darker above; a series of 4 obscure oblong dark blotches along middle of sides; a dark spot at base of caudal: each side of nape with an intense blue-black spot larger than eye: an obscure dusky streak from eye forward to mouth. Both dorsals translucent, with series of bright reddish-brown spots as large as pupil: upper lobe of caudal light reddish, the lower blue-black; anal and ventrals dusky-bluish; pectorals slightly dusky, with a narrow bright pinkish border behind. Body very elongate; head compressed; cheeks high and vertical; snout very short, vertically rounded. Mouth nearly horizontal, large, the maxillary nearly half head, reaching about to posterior margin of orbit; upper jaw with an outer series of strong curved eanines, the inner series and those in lower jaw small. Interorbital width about equaling pupil; eye about \(\frac{1}{2}\) head; gill-opening 2\(\frac{1}{2}\) in head; the isthmus wide. Dorsal spines not filamentous; soft dorsal and anal high, reaching caudal when depressed; caudal lanceolate, the middle rays produced, 2% in length. Pectoral rays not silk-like. Body covered with small ctenoid scales, much reduced anteriorly; head, antedorsal region, and breast naked. 9 with smaller mouth and no red on fins. Charleston, S. C.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

Page 634. Gobius carolinensis Gill is indistinguishable from Gobius soporator, and may be suppressed. Gobius mapo Poey (Mem. Cuba, ii, 277), seems to be the same species.

Page 634. Gobius gulosus Grd. is a species of Lepidogobius, and should be transferred to page 638, after L. newberrii. It may be thus defined: 992 (b), 986. L. gulosus (Grd.) J. & G.

Light olive, with sharply-defined markings of dark brown; those on the head mostly longitudinal streaks; those on the body forming dark

Bull. Nat. Mus. No. 16-60

cross-bars and blotches; fins mostly spotted or barred. Body elongate. Head large, low, not very blunt. Mouth large, very oblique, the mandible strongly projecting; the maxillary extending to below middle of pupil, 2 in head. Teeth in few series, those of the outer row very long, slender, and curved. Scales small, cycloid, imbedded. Head and nape scaleless. Dorsal spines slender, the longest somewhat filamentous; caudal long; upper pectoral rays not silk-like; ventrals inserted directly below pectorals. Head 3½; depth 5. D. VI-15; A. 16; Lat. 1, 42. L. 3 inches. Florida to Texas.

(Gobius gulosus Grd. U. S. Mex. Bound, Surv. Ichth. 1859, 26.)

Page 635. Before Gobius glaucofranum insert—

# 987 (b). G. boleosoma J. & G.

Pale olivaceous, mottled with darker; male with a black humeral spot; fins barred, their edges tinged with orange. Form, size, and coloration of *Bolcosoma olmstedi*. Head not very blunt. Mouth moderate, horizontal, the lower jaw included; the maxillary reaching nearly to middle of eye. Teeth small, slender, in narrow bands, the outer somewhat larger. Scales moderate, etenoid. Dorsal spines not filamentous; caudal pointed, slightly longer than head; upper rays of pectorals not silk-like. Head 4; depth  $4\frac{1}{2}$ . D. VI-12; A. I, 11; Lat. l. 33. L. 2 inches. Pensacola, Fla.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 295.)

# 987 (c). G. stigmaturus Goode & Bean.

Light olive, sides marbled with whitish; a dusky spot on opercle and one below  $\epsilon$ ye; sides with 5 dusky blotches along median line, the last one a round black spot at base of caudal; vertical fins with wavy blackish bars; paired fins plain. Form of G, bolcosoma; head not very blunt; snout little shorter than eye; lower jaw not shorter than upper. Maxillary extending to below middle of eye,  $2_3^2$  in head. Teeth strong, curved, those of the upper jaw in a narrow band, two of the teeth somewhat canine-like; lower teeth large, in a single irregular series. Scales large, those on the nape reduced, all etenoid. Dorsal spines slender; fins not clevated; caudal as long as head; upper rays of pectoral not silk-like. Head 4; depth 6. D. VI-12; A. 12; Lat. l. 30. L. 2 inches. West coast of Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 418.)

# 987 (d). G. nicholsi Bean.

Olivaceous; scales edged with dusky; top of spinous dorsal black; second dorsal and caudal spotted with dark; ventrals black. Body

stout, compressed. Snout obtuse, about as long as eye; maxillary reaching front of pupil; lower jaw slightly projecting; teeth slender, in several series, the outer enlarged. Last rays of soft dorsal nearly as long as head; caudal convex, nearly as long as head; pectoral as long as head, none of its rays silk-like. Scales large; head naked. Head  $3\frac{3}{4}$ ; depth  $4\frac{1}{2}$ . D. VI-14; A. 12; scales 26-10. L.  $4\frac{1}{2}$  inches. Coast of British Columbia. (Bean.)

(Bean, Proc. U. S. Nat. Mus. 1881, 469.)

Page 636. After Gobionellus oceanicus add:

# 989 (b). G. stigmaticus Poey.—Esmeralda.

Brown; head with 4 vertical broad black bands; 3 on the cheek, 1 on the opercle; body with 10 narrow vertical yellow bars; pectorals and candal with cross-rows of brown spots; ventrals yellow, with black edgings; a small black shoulder spot. Profile bluntly decurved; maxillary reaching past middle of orbit. Teeth slender, in bands, the outer row enlarged. Pectoral as long as head; caudal pointed, half as long as body. Scales ciliated. Head 4; depth 4½. D. VI-12; A. 13; Lat. 1. 30. (Poey.) Southern Florida (Bean) to Cuba.

(Smaraydus stigmaticus Poey, Memorias Cuba, ii, 281, 1850; Poey, Syn. Pisc. Cub. 394.)

The scales in Gobionellus oceanicus vary considerably. Lat. 1. 60 to 80.

Page 637. After Lepidogobius gulosus add:

# 992 (c). L. thalassinus Jor. & Gilb.

Body translucent, very thickly covered with very minute, shining-green dots, least numerous on tail; three conspicuous translucent bars, wider than the interspaces, crossing sides immediately behind head; two narrow brilliantly-green lines running obliquely across cheeks; dorsals whitish, with two or three lengthwise series of large reddish-brown spots; spinous dorsal blackish at base; anal whitish at base, the anterior rays tipped with brilliant white, the greater portion of fin, as well as lower part of caudal fin, blackish; upper caudal rays marked with red; ventrals light buff; pectorals translucent. Body elongate, much compressed; caudal peduncle very narrow and short; head compressed, much higher than wide, with very short, acute snout; mouth terminal, wide and oblique; the jaws equal; maxillary reaching vertical from middle of orbit, half length of head. Teeth apparently in a very narrow band, behind an outer series of strong conical teeth (the inner band cannot be certainly verified in our specimens). Eyes high, sepa-

rated by a very narrow interorbital space. Dorsal spines slender, the fifth slightly produced, reaching base of third soft ray when depressed. Last rays of dorsal and anal reaching slightly past base of eaudal. Caudal lanceolate, the middle rays produced,  $2\frac{2}{3}$  in body. Upper pectoral rays not silk-like. Ventral longer than head, reaching beyond front of anal. Body covered with very small cycloid scales, which are readily decidnous; head naked. Head  $3\frac{1}{2}$ ; depth  $4\frac{2}{4}$ . D. VII-16; A. 15. L.  $1\frac{1}{2}$  inches. Charleston Harbor. This species is closely allied to L. emblematicus Jor. & Gilb., from Panama.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

Page 638. Instead of Gobiosoma alepidotum read:

993. G. bosci (Lac.) J. & G.

To the synonomy add:

(Gobius bose Lacépède, Hist. Nat. Poiss. ii, 555, 1800. The name alepidotus was given by Schneider in 1801 as a substitute for this personal name.)

Page 638. Gobiosoma molestum is not distinguishable by us from G. bosci. It may therefore be suppressed.

Page 638. After Gobiosoma bosci add:

993 (b). G. ios Jor. & Gilb.

Light olive; back, sides, and upper fins speckled with dark olive; caudal with 3 or 4 dark olive cross-bars; lower fins pale. Body long and slender, moderately compressed; head long and low, anteriorly pointed, its profile scarcely convex; mouth very large, oblique, the jaws subequal; maxillary reaching middle of cheek, its length more than half head; teeth slender, in moderate bands, the outer somewhat enlarged. Eye as long as snout,  $4\frac{1}{2}$  in head. Body entirely naked. Fins low, the spines slender; caudal short. Head  $4\frac{1}{6}$ ; depth  $6\frac{2}{3}$ . D. VI-15; A. 12. L. 2 inches. Puget Sound; one specimen known, from the stomach of a Hexagrammus asper.

(Jor. & Gilb. Proc. U. S. Nat. Mns. 1882.)

Page 639. After Tyntlastes sagitta add:

# 350 (b).—IOGLOSSUS Bean.

(Bean, Proc. U. S. Nat. Mus. 1882, 419: type Ioglossus calliurus Bean.)

Body elongate, strongly compressed, of equal depth throughout, covered with very small, mostly eyeloid, scales. Head short, compressed, not keeled above; mouth large, oblique, the lower jaw projecting; teeth in narrow bands or single series, some of them canine; no teeth

on vomer or palatines; tongue very slender, sharp; opercles unarmed. Gill-openings very wide, the membranes narrowly joined to the isthmus on the median line. No lateral line. Branchiostegals 5. Dorsals separate; the first of 6 very slender, flexible spines; the second elongate, similar to the anal; caudal long and pointed, free from dorsal and anal; ventrals close together, separate, each of one spine and four rays, their insertion below or behind pectorals; anal papilla present. ( $\omega_5$ , dart;  $\gamma \lambda \tilde{\omega} \sigma \sigma a$ , tongue.) A remarkable type, belonging to the Oxymetopontinue, differing widely from our other Gobioid fishes.

# 996 (b). I. calliurus Bean.

Light olive, without distinct markings (in spirits); tip of first dorsal dusky; caudal apparently with a median reddish stripe and two bluish bands. Head not crested, its upper surface gently rounded; maxillary extending to opposite front of pupil,  $2\frac{1}{6}$  in head; upper jaw with about 2 series of teeth, the outer enlarged; 2 curved canines behind the band; lower jaw with about 1 row of smaller teeth, besides about 4 canines. Eye large, twice length of snout,  $3\frac{1}{5}$  in head. Gill rakers long and slender. Dorsal fins contiguous, the longest spine filamentous, about as long as head; candal lanceolate, half as long as rest of body; ventrals inserted very slightly in advance of pectorals, nearly as long as head. Scales minute, mostly cycloid. Head 5; depth  $7\frac{1}{4}$ . D. VI=22; A. I, 21. L. 4 inches. Deep water off Pensacola, Fla.

(Bean, Proc. U. S. Nat. Mus. 1882, 419; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 297.)

Page 642. Hexagrammus ordinatus is a typical Hexagrammus, having the dorsal fin divided. The genus Pleurogrammus should probably be adopted for H. monopterygius, which is, in Alaska, one of the most important food-fishes, according to Dr. Bean.

Page 644. Dr. Bean considers our suggestion, that Hexagrammus scaber is the young of H. asper, as improbable. The following are the characters assigned to the former species:

# **999** (b). **H. scaber** Bean.

Light brown, silvery below; each dorsal with 3 dark blotches, smaller than eye, not reaching base of fin: pectorals, ventrals, and anal immaculate. Teeth on jaws and vomer; none on palatines. A tentacle above eye. Six lateral lines on each side; the supplemental one faint, extending backward from above base of pectoral, disappearing near middle of body. Scales everywhere very rough. Caudal forked; dorsal deeply

notched. Head 4\frac{1}{4}; depth 4\frac{1}{2}. D. XX, 24; A. 23; Lat l. 105; l. tr. 50. L. 3 inches. Coast of Alaska; known from young specimens only.

(Bean, Proc. U. S. Nat. Mus. 1881, 154.)

Page 661. Sebastodes proriger ranges northward to Alaska, where it grows to a considerable size. In the original descriptions, both of "Epinephelus ciliatus" and "Perca variabilis," it is evident that S. proriger has been confounded by Tilesius and Pallas with the species for which we have retained the name of S. ciliatus.

On page 665, after Sebastodes ruber, add:

# 1019 (b). S. umbrosus J. & G.

Light orange, overlaid everywhere with blackish, the latter color forming on the lower part of the sides reticulations in fine pattern, the centers of the scales being paler than the edges: sides of head with dusky shades; sides of back with some large areas of blackish; upper parts with 5 large rounded blotches of pink washed with orange, these blotches arranged as in constellatus, but larger, less sharply defined, and of a different hue; the second blotch with a smaller one above it; a rosy spot on opercular flap; fins pale orange, shaded with dusky. General form of constellatus. Mouth moderate, oblique, the lower jaw scarcely projecting, its tip fitting into the emarginate tip of upper jaw; maxillary 2 in head, reaching posterior margin of pupil; both jaws with small, smoothish scales. Cranial ridges rather sharp, lower than in constellatus; preocular, supraocular, postocular, tympanie, and occipital spines present; interorbital area concave, with two prominent ridges; the region much broader than in constellatus, 3 width of eye; supraocular ridge low, its spine smaller than tympanic spine; preocular prominent; preopercular spines all acute; preorbital narrow, with two spines. Eye large, 4 in head. Gill-rakers rather long and slender, the longest about half eye. Scales moderate, with many accessory scales. Dorsal rather low, deeply emarginate; fourth spine equal to soft rays, about & head; soft dorsal longer than high; second anal spine large, 24 in head; candal slightly emarginate; pectoral not reaching vent. Head  $2\frac{3}{5}$ ; depth  $2\frac{4}{5}$ . D. XIII, 12; A. III, 6; Lat. l. 40 33 in body. Santa Barbara, California. (tubes).

(Sebastichthys umbrosus Jor. & Gilb. Proc. U. S. Nat. Mus. 1882.)

Page 679. The species here called *Scorpana dactyloptera* proves to have been correctly identified with the European species. It has lately been taken in considerable numbers along the Gulf stream. The

pectorals in this species are subtruncate, the lower rays somewhat exserted. The group called by Poey "Pontinus" is not of this type, but allied rather to Scorpæna proper.

Page 681. Scorpæna porcus should probably be erased, its occurrence in our waters being very doubtful. The following species has been, perhaps, mistaken for it:

# **1038** (b). **S. stearnsi** Goode & Bean.

Dusky olivaceous, whitish below: head with some dark blotches and small spots; back and sides with diffuse blackish blotches; body sparsely covered with round dusky spots, smaller than pupil: these spots most numerous and distinct in the axillary region, which is otherwise whitish; spinous dorsal marbled, with a median dusky band; its base whitish, with black spots: soft dorsal and anal irregularly marbled: caudal with a broad median and a terminal band of blackish: pectorals mottled and banded; ventrals dusky at tip. Body robust, little compressed, tapering posteriorly. Mouth moderate, oblique, the jaws equal, the lower with a small symphyseal knob; maxillary 2 in head. reaching to below posterior margin of orbit. Preorbital with two diverging spines; suborbital without deep pit, its stay low, armed with two small spines; nasal spines inconspicuous; interorbital space deeply concave, with 2 longitudinal ridges, its width 3 diameter of eye. Cranial ridges rather low, moderately sharp; the following pairs present: preocular, supraocular, postocular, coronal, occipital, nuchal, besides 3 on the temporal region, arranged in a right line behind the eye. Occipital pit deep, a little broader than long. Preopercular spines 5, the two lower blunt and short, the upper much the longest. half as long as the eye; a small spine at its base. Supraocular flap very small, trilobate, shorter than pupil (much larger in a young example, apparently of the same species, in which its length is about half head). Small dermal flaps elsewhere on head. Opercular flap scaly; a few rudimentary scales on cheeks and front of opercle. Breast with small scales. Gill-rakers short and thick. Scales large, smooth, with membranous edges; a series of dermal flaps along the lateral line and at the dorsal base. Dorsal spines slender, the longest 21 times in head; longest soft ray half as long as head; caudal subtruncate, 1½ in head. Anal spines small, the second and third equal, 24 in head. Longest soft ray of anal half as long as head. Ventrals 13 in head. reaching soft rays of anal, the longest ray slightly shorter than head;

base of the fin a little procurrent, its length 3 in head. Head  $2\frac{3}{5}$ ; depth  $2\frac{5}{6}$ . D. XI, I, 9; A. III, 5; P. 20; Lat. l. 32 (31 tubes). South Carolina to Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 421.)

#### 1038 (c). S. calcarata Goode & Bean.

Color essentially as in S. stearnsi: axil of pectoral whitish, with dusky specks, a black spot at its upper edge; ventrals mostly black. Body moderately robust; lower jaw slightly projecting, with a small symphyseal knob; maxillary reaching past pupil, its length half head. Suborbital without pit, the bony stay moderate, armed with 2 small spines. Nasal spines small. Interorbital space narrow, with 2 longitudinal ridges, its width \(\frac{2}{5}\) length of eye. Cranial ridges rather low, with sharp spines, arranged as in S. stearnsi. Occipital cavity almost obsolete, represented by a slight depression. Preopercular spines 5. the lowermost stout, directed downward and forward, the uppermost rather long, more than half eye. Opercular and scapular spines moderate. Eye large, nearly 3 in head. Supraocular flaps minute; a few other small flaps on head. Cheeks with rather large imbricated scales: opercle, with some scales anteriorly and on its flap; breast scaly; scales of body large, not etenoid, with few dermal flaps or none. Pores of lateral line very conspicuous. Gill-rakers short and small. Dorsal spines rather slender, the longest 23 in head; longest soft ray 25 in Anal spines small, the second and third subequal, 3 in head. Soft anal rays moderate. Ventrals reaching past vent, 13 in head. Pectoral long,  $1\frac{1}{5}$  in head. Depth 3. D. XI, I, 9; A. III, 5; P. 19; Lat. 1. 28 (25 tubes). West coast of Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 422.)

Page 688. Cottunenlus microps is very fully described and well figured by Collett, Norske Nord-Havs Exp. 1880, 18. The eye is here represented as shorter than snout, and about 6 in head, the pectorals reach past front of anal, and the dorsal rays are VI-13 to VI-15. It is possible that the American species is different, but the resemblance of the two is very great.

Page 691. It is thought by Collett (Norske Nord-Havs Exp. 1880, 34) that *Icelus bicornis* is identical with *Icelus hamatus*. If this supposition is correct, the species should stand as 1048, *I. bicornis* (Reinh.) Gill. *Icelus furciger* Malm (Forh. Skand. Naturf. 1863, 410) is identical with *I. hamatus*. In life the head of this species is provided with very slender cirri.

Page 694. Instead of Uranidea spilota read:

# 1054. U. ricei (Nelson) J. & G.

Erase the synonym "Uranidea spilota Cope," etc. U. spilota is probably a distinct species, allied to U. comata.

Page 695. After Uranidea semiseabra add:

### 1056 (c). U. rhothea Rosa Smith.

Dusky, with blackish cross-bands above, yellowish and punctulate below; fins all more or less spotted and barred. Body moderately elongate. Head broad and flattish; interorbital space broad and little concave, nearly as broad as eye. Mouth moderate, the maxillary extending about to middle of pupil; jaws subequal; palatine teeth conspicuous; preopercular spine shortish, nearly straight, directed upward and backward. Skin of head smooth; skin of back and sides rough, with short, rather coarse prickles, shorter and stiffer than in *U. aspera*. Fins moderate; pectoral barely reaching past front of anal. Head 3; depth  $4\frac{3}{5}$ . D. VIII-15; A. 11; V. I, 4. Spokane Falls, Upper Columbia River.

(Rosa Smith, Proc. U. S. Nat. Mus. 1882, 347.)

Page 697. Under *Uranidea richardsoni* add another "variety"—var. *kumlieni* (Hoy).

The original type of *U. kumlieni* Hoy, lately re-examined by us, has palatine teeth, and the ventrals I, 4. It represents, in our present view, a variety of *U. richardsoni*, possibly distinguishable from var. *bairdi* by the rather higher spinous dorsal and rather larger eye and mouth. The description of "*U. franklini*," on page 699, belongs to *U. kumlieni*, being taken from Hoy's type.

Page 698. To the account of *Uranidea cognata* may be added: Month larger than in *Uranidea gobio*; head 3 in length without candal; its width equal to its length and half more than its height; jaws equal; vent a little nearer snout than insertion of caudal; second dorsal twice as long as first, separated from it by a space less than a line; anal beginning opposite sixth ray of dorsal; caudal 6 in total length. Under surface silvery gray, minutely dotted; on the sides the dots are mingled with crowded irregular blotches of dark brown; back and top of head nearly uniform dark brown, few pale spots appearing. L. 4 inches. (*Richardson.*)

Page 698. After Uranidea cognata add:

# 1062 (b). U. spilota Cope.

Brown above, yellowish below, everywhere densely punctulate with darker except on the belly; dorsals, caudal, and pectorals barred; anal yellowish; dorsal and base of caudal with blackish spots; sides with large dark spots, forming sometimes seven or fewer cross-bars. Body rather elongate. Eye 4½ in head, one-third greater than interorbital width. Head slightly contracted laterally, not much depressed; one preopercular spine (hooked upward); pectoral reaching vent and front of second dorsal, its rays undivided. Spinous dorsal low; anal beginning opposite fourth ray of spinous dorsal. No trace of palatine teeth. Lateral line incomplete. Head 3½; depth 5. D. VIII-17; A. 13; V. I, 4: P. 15; B. 6. L. 3 inches. Grand Rapids, Michigan. (Cope.)

1062 (c). **U. pollicaris** J. & G.

sides and below light, unmarked; dorsals, pectora's, and caudal with series of spots. Head much depressed; snout broad and flat; profile straight or slightly concave from nape to tip of snout; mouth small, anterior; maxillary reaching vertical from front of orbit; teeth on vomer, none on palatines. Preopercular spine large and strong, spirally curved upwards and inwards; a single concealed point below this on margin of preopercle. Spinous dorsal rather low, connected with the long, low second dorsal by membrane; longest dorsal spine equalling length of snout; origin of anal under third dorsal ray; last ray of anal under sixteenth of dorsal; ventrals I, 4, reaching  $\frac{2}{3}$  distance to vent; pectoral rays all simple; vent midway between tip of snout and base of caudal. Lateral line continuous to base of caudal. No

Light olive above, blotched and spotted with black; lower part of

(Jor. & Gilb. Proc. U. S. Nat. Mus. 1882.)

Page 699. Instead of the description of *Uranidea franklini*, given in the text, insert the following:

prickles. Head  $3\frac{3}{5}$  in length; depth  $4\frac{3}{4}$ ; eye  $5\frac{1}{3}$  in head. D. VII-19;

# 1069. U. franklini (Ag.) Jor.

A. 13; P. 17. Lake Michigan.

Body rather short and stout; snout not very obtuse; maxillary reaching about to pupil; eye 4 in head, twice the interorbital space; preopercular spine hook-like, very acute; paired fins rather short, the pectorals not reaching vent; first dorsal nearly as high as second;

dorsals contiguous; anal inserted under fourth ray of second dorsal; caudal 6 in length; lateral line incomplete; vent nearer base of caudal than tip of snout. Head  $2\frac{1}{2}$ ; depth  $4\frac{1}{2}$ . D. VIII-17; A. 12; V. I, 3. L. 3 inches. Lake Superior. (Girard.)

Page 699. After Uranidea franklini add:

1069 (b). U. formosa (Grd.) Jor.

Body slender and graceful; head small, depressed above; eyes moderate; preopercular spine short, stont, acute, curved upwards; a small spine below it; subopercular spine well developed. Dorsals well separated; anal beginning under third ray of soft dorsal; pectorals not reaching to posterior margin of spinous dorsal; ventrals not nearly to vent. Head  $4\frac{1}{4}$ . D. VIII-16; A. 11; V. 1, 3. L.  $3\frac{1}{4}$  inches. Deep water in Lake Ontario. (Girard.)

(Cottus formosus Girard, Mon. Cott. 58, 1850.)

Page 703. To the synonymy of Cottus scorpius grænlandicus add:

(Cottus mitchilli C. & V. iv, 188: Cottus porosus C. & V. viii, 498: Acanthocottus occllatus II. R. Storer, Bost. Journ. Nat. Hist. 1850, 253: Cottus glacialis Rich. Last Arctic Voyage Belch. ii, 349, 1855: Acanthocottus mucosus Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 12.)

Page 712. A minute patch of palatine teeth is sometimes present in *Liocottus hirundo*.

Page 726. Instead of Brachyopsis read:

#### 383.—LEPTAGONUS Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1831, 259: type Agonus spinosissimus Kröyer = Agonus decagonus Bl. & Schn.)

The species should stand as—

a. Lower jaw projecting. (Brachyopsis Gill.)

1112. L. rostratus (Tiles.) J. & G.

1113. L. verrucosus (Lock.) J. & G

1114. L. xvosternus J. & G.

aa. Lower jaw included. (Leptagonus.)

1115. L. decagonus (Bl. & Schn.) J. & G.

The following description of L. decagonus may be substituted for that given in the text:

Greyish yellow, with 2 to 4 large transverse brown spots; tips of pectorals and caudal blackish; a black streak through eye across preo-

percle. Body slender; head rather low; mouth large, subinferior, the snout projecting beyond it; gill-membranes free from isthmus (fide Collett in lit.); five long cirri near the angle of mouth, one of them forked; a forked cirrus on lower jaw; snout longer than the large eye; the longest cirri about as long as snout; a pair of short spines on snout; a pair of knotty protuberances above eye, and a pair of larger ones on frontal region; shields of anterior part of back each with a large keel ending in a spine; keels elsewhere bluntish; plates of breast tubercle-like and striate; 4 shields between dorsals; 5 before first dorsal; 17 before second; 12 between ventrals and anal. Pectorals slightly longer than head; ventrals moderate, longest in the males, the vent close behind them. Head 5; depth 8. D. VI-7; A. 7; Lat. l. 40, the number of pores about 24. L. 9 inches. Greenland to Norway. (Collett.) (Collett., Norske Nord-Havs Exp. 1850, 44.)

Page 728. Agonus cataphractus.

This species should probably be omitted as not occurring within our limits, the Greenland references belonging to *Leptagonus decagonus*.

Page 728. The genus *Bothrayonus* Gill here appears for the first time, the portion of Bull. U. S. Nat. Mus. XI, in which it was to be characterized having been withdrawn by the author.

Page 733. Trigla cuculus should doubtless be omitted. It probably has never been taken on our coasts.

Page 734. Instead of 1123, Prionotus punctatus read:

# 1123. P. scitulus J. & G.

For the synonymy given, substitute—

(Prionotus punctatus Jor. & Gilb. Proc. U. S. Nat. Mus. 1878, 373, not of C. & V.; Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 228.)

Page 734. After Prionotus scitulus read:

#### 11: 3 (b). P. punctatus (Bloch) C. & V.

Olivaceous, with some small roundish spots; dorsal with a dark blotch between fifth and sixth spines; soft dorsal and caudal faintly barred; pectoral with two large blackish spots near its middle above, besides numerous pale bars and spots. Body not very slender; pectorals rather short, not reaching end of soft dorsal, slightly less than half length of body; free rays of pectoral slender; band of palatine teeth short, rather broad; maxillary  $2\frac{1}{2}$  in head, not reaching eye; preorbital feebly serrated, its edge armed with two rather strong

spinous teeth, hooked backwards. Snout wide, the distance between angles of month scarcely less than half head; grooves between orbits behind not deep. Head 3; depth 4. D. X-12; A. 11; Lat. l. 57. West Indies, said to range northward to our coasts, but perhaps confounded with *palmipes* and *scitulus*; the specimens here described from Hayana.

(Trigla punctata Bloch, Ausl. Fische, taf. 352; C. & V. iv, 93; Günther ii, 193.)

Page 738. Instead of Cephalacanthus spinarella read:

#### 1128. C. volitans (L.) J. & G.

The specimen to which Linnaus gave the name of "Gasterosteus spinarella" was said to have come from India. It is therefore more likely to have been a young specimen of the one of the East Indian species (perhaps C. orientalis C. & V.) than of the Atlantic species rolitans.

Page 740. After Careproctus gelatinosus add:

### 1130 (b), C. reinhardi Kröyer.

Reddish gray. Body semitransparent, covered with viscid skin. Head short and globular. Eye 5 to 6 in head. Caudal fin very slender, joined to the dorsal and anal; mouth nearly horizontal; lower jaw scarcely projecting. Ventral disk little larger than eye. Pectorals deeply emarginate, nearly as long as head, reaching anal; the lower rays exserted, appearing as a series of short twisted filaments. Distance from ventral disk to vent not more than diameter of eye; head with conspicuous mucous pores. Head 4½; depth 5½. D. 54; A. 45; C. 12; P. 32. Greenland to Jan Mayen. (Collett.)

(Liparis gelatinosus Reinh. Oversigt, &c. 1844, 77, not of Pallas: Liparis (Careproctus) reinhardi Kröyer, Naturh. Tidskr. i, 252, 1862; Collett, Norske Nord-Havs Exped. 1850, 57.)

Page 742. According to Professor Collett, *Liparis arctica* Gill is a variety of *Liparis lineata*, distinguished from the latter by its uniform coloration only. Other varieties of this species are characterized by Collett (Forh. Vid. Selsk. i, 44, 1879).

Page 746. The genus

#### 395 (b).—EUMICROTREMUS Gill.

is probably worthy of adoption. Its single species may stand as— 1144. E. spinosus (Müller) Gill. Page 749. After Gobiesox strumosus.add:

# 1147 (b). G. virgatulus J. & G.

Olivaceous, with paler spots and fine black dots; the whole body covered with wavy, longitudinal lines of a light orange color (fading in spirits); vertical fins dusky, somewhat barred; caudal tipped with yellowish. Body rather slender; cheeks prominent; mouth reaching front of orbit; lower jaw somewhat included; teeth above in a narrow band; four of the outer somewhat enlarged; incisors of lower jaw entire; ventral disk a little shorter than head. Eyes small, 4 in head, less than half the broad interorbital space. Head 3; its width 3½; depth 6. D. 10; A. 8. L. 1½ inches. Pensacola, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 293.)

Page 751. No. 1149 (b), Batrachus pardus Goode & Bean, should probably be considered a distinct species. It is a deep-water form, with flabby skin.

Page 751. Instead of Porichthys porosissimus read:

# 1150. P. margaritatus (Rich.) J. & G.

Omit from the synonymy *Batrachus porosissimus* C. & V. (a species from Surinam, the identity of which with our species is not proven) and insert (*Batrachus margaritatus* Richardson, Voyage Sulphur. Fishes, 67). *P. margaritatus* appears to range from Lower California to Vancouver's Island.

Page 752. After P. margaritatus add:

# 1150 (b). P. plectrodon J. & G.

Coloration essentially as in P. margaritatus, but rather paler and more golden; the lines of pores and shining spots very similar. Palatines each with few teeth (4 or 5); 1 to 3 of these developed as very strong canines (usually much larger than the canines on vomer), which are strongly curved forwards and inwards (in P. margaritatus the palatine teeth are more numerous, subequal, small, much smaller than canines on vomer). Head  $3\frac{3}{4}$ ; depth  $5\frac{5}{5}$ . D. II-37; A. 34; V. I, 2. L. 8 inches. South Carolina to Texas.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1832, 291.)

Page 757. After Chasmodes quadrifasciatus add:

#### 1154 (b). C. saburræ J. & G.

Male deep olive, with dark cross-shades; numerous pale spots on the sides which form undulating lines converging backwards; dark stripes

downward and forward from eye; top of head and upper part of dorsal fin usually with fine black spots; spinous dorsal with a median orango longitudinal band; other fins mostly dusky olive. Female with about 8 blackish cross-bands extending on the dorsal fin; the body everywhere with pale spots; fins all sharply barred with blackish and olive. Body deeper than in C, bosquiunus; the head shorter, blunter, and the mouth notably smaller; maxillary not reaching posterior margin of eye, its length  $2\frac{1}{3}$  in head; teeth occupying about half of lower jaw; height of gill-slit  $3\frac{2}{3}$  in head, its lower edge opposite third ray of pectoral. A minute cirrus, shorter than pupil above each eye and each nostril. Dorsal continuous, with slender rays, the last one joined to the caudal. First two rays of anal short, thick and fleshy in the males. Head  $3\frac{2}{5}$ ; depth 3. D. XII, 17; A. II, 18. L. 4 inches. Pensacola Bay, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 298.)

Page 757. Instead of 1155, Isesthes gentilis read:

# 1155. I. gilberti Jordan.

From the description on page 757, erase the phrases "a blue spot on the dorsal in front; males with golden stripes on lower parts of head," and insert "no sharp markings in either sex." This species is known from Santa Barbara and San Diego. It may be readily distinguished from *I. gentilis* by its stiff spines and multifid orbital tentacles, as well as by the color.

Instead of the synonomy, on page 758, substitute:

(Jordan, Proc. U. S. Nat. Mus. 1882, 349.)

Page 758. After Isesthes gilberti add:

# 1155 (b). I. gentilis (Grd.) J. & G.

Brown; males with the whole body closely mottled and blotched with darker brown, the light ground color forming reticulations around darker spots; dark spots close-set on head; lower part of side of head behind mouth with two sharply defined parallel vertical pale bars (said to be yellow in life); back with about 6 dusky cross-shades; a bluish spot on spinous dorsal in front. Female with the spots on body duller, the bands on head obsolete, and the spot on front of spinous dorsal jet black and conspicuous; fins all mottled. Body rather robust, the head very bluntly rounded in profile. Orbital tentacle simple, in the male one-third length of head, in the female much smaller; gill-opening not extending downward to lower edge of pectorals. Dorsal fin continuous, its spines low and flexible. Caudal free from dorsal and

anal. Head 33; depth 4. D. XIII, 17; A. 19; L. 4 inches. Monterey to Cape San Lucas.

(Blennius gentilis Girard, Proc. Acad. Nat. Sci. Phila. 1854, 149: Blennius gentilis Günther, iii, 217: Blennius gentilis Steind. Ichth. Beitr. v, 150, 1876; Jordan, Proc. U. S. Nat. Mus. 1882, 350; not Isesthes gentilis of the present work, page 757, which is Isesthes gilberti.)

# Page 758. After Isesthes punctatus add:

# 1156 (b). I. hentzi (Le S.) J. & G.

Light bluish-ash, mixed with rufous, with numerous irregular black and rufous spots; dorsal black, with whitish spots; soft dorsal with 5 dark bands; ventrals blackish, with pale bands; caudal with 3 or 4 dark bands. Body little elongate; snout very short, but not vertically truncate; eyes above angle of mouth, placed high; gill-slit extending from level of base of pectoral fins to height of eye; teeth equal; dorsal slightly depressed in the middle; pectorals large; a short cirrus above each eye and a smaller one over each nostril. Depth  $3\frac{1}{3}$  (in total). D. XI, 14; A. 16. Charleston Harbor, South Carolina. (*Le Sueur*.)

(Blennius hentz Le Sueur, Journ. Acad. Nat. Sci. Phila. iv, 363, 1825.)

# 1156 (c). I. ionthas J. & G.

Clear olive-green with traces of darker bars, everywhere densely freekled with small round blackish spots, smaller than the pupil, these very small on sides of head; a golden area behind eye, followed by a blackish crescent; two dark bars separated by a yellowish area below eye; fins all olive-green. Body rather deep. Head short, but less blunt than in *I. punctutus*. Mouth small, the maxillary searcely reaching eye; teeth subequal; orbital cirrus low, searcely longer than nasal cirrus, which is about as long as pupil. Gill-slit half head, its lower edge just below middle of pectoral. Dorsal continuous, its spines low and not very stiff; its soft rays free from caudal. Head 4; depth 3\frac{1}{2}. D. XII, 14; A. 16. Pensacola Bay.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 299.)

# 1156 (d). I. scrutator J. & G.

Deep olive-green, nearly uniform; a golden blotch behind eye, followed by a dark crescent; two dark bars separated by a yellowish area below eye; fins plain dusky greenish. Body rather deep, compressed; head short, very blunt; mouth very small; teeth subequal; orbital cirri very long, reaching front of dorsal, about half length of head; gill-slit  $2\frac{1}{2}$  in head, its lower edge just below middle of pectoral. Dorsal scarcely emarginate, its spines stiff; the soft rays slightly joined

to caudal; pectoral as long as head. Head  $3\frac{1}{5}$ ; depth  $3\frac{4}{5}$ . D. XII, 14; A. 18. South Carolina to Texas.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 300.)

Page 759. After Blennius fucorum add:

# 1159 (b). B. stearnsi J. & G.

Light greenish olive, with irregular dark bars extending on the fins; skin finely punctate; spinous dorsal and anal dusky. Body comparatively elongate, compressed; snout short and blunt; the profile moderately decurved; mouth large, oblique, the jaws equal, the maxillary reaching slightly beyond middle of orbit,  $2\frac{1}{4}$  in head; teeth  $\frac{26}{24}$ ; both jaws with strong curved canines posteriorly; eye moderate, equal to snout,  $4\frac{1}{3}$  in head; supraorbital tentacle forked near the base, as long as snout and orbit; no nuchal filament; gill-membranes nearly free from isthmus, forming a broad fold across it. Dorsal high, continuous, its spines subequal, very slender, the highest half head; candal distinct,  $1\frac{1}{3}$  in head; ventrals not quite reaching vent. Head  $3\frac{1}{5}$ ; depth  $4\frac{2}{3}$ . D. XI, 18; A. II, 21. Pensacola, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 300.)

#### 1159 (c). B. favosus Goode & Bean.

Brownish, finely reticulated; a series of bluish blotches on sides; front and sides of head and base of pectoral with a very distinct honeycomb-like net-work of blue lines around hexagonal interspaces; top of head with small oblong blue spots; a black occilated spot between first and second spines of dorsal; anal with oblique blue streaks. Body clongate, compressed; anterior profile moderately decurved. Mouth large, the maxillary reaching posterior border of orbit; each jaw with curved posterior canines. Supraocular cirrus very long and slender, trifid to the base, the main branch nearly as long as head; no nuchal cirrus. Gill-membranes forming a rather narrow fold across isthaus. Dorsal low, continuous, the spines very slender and flexible; the last soft ray slightly joined to caudal. Head 3\(^2\_3\); depth 4\(^3\_4\). D. XII, 18; A. II, 20. Garden Key, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 416.)

# 1159 (d). B. asterias Goode & Bean.

Olivaceous, with about 6 dark cross-bars, which extend on the dorsal fin; anal and posterior half of body with numerous round, whitish, stellate spots, probably blue in life; bluish streaks from eye across the cheeks; fins vaguely marked. Body moderately elongate, compressed,

Bull. Nat. Mus. No. 16——61

the head very blunt and deep, almost as deep as long; its anterior profile straight and nearly vertical. Mouth moderate, the maxillary reaching past front of eye, 3 in head; lower jaw with 2 short, stoutish, posterior canines; upper jaw without canines. Supraocular eirri small, fringed, about as long as pupil. Nape with a longitudinal dermal crest reaching to front of dorsal, provided with a series of about 20 filaments, the longest about as long as the eye. Gill-membranes forming a broad fold across the isthmus. Dorsal rather low, nearly continuous, beginning on the nape in front of the preopercle; spines all slender and tlexible, the longest  $\frac{3}{8}$  length of head. Caudal free from dorsal and anal. Head 4; depth 4. D. XI, 16; A. 19. Garden Key, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 416.)

Page 763. In *Clinus evides*, as in *Heterostichus rostratus*, the inner edge of the shoulder-girdle is armed with an upturned, spine-like hook, not found in any other of our species. This character seems to exist in typical species of *Clinus*, and in *Cristiceps*, but not in *Labrosomus* or *Cremnobates*.

Page 764. After Cremnobates integripinnis add:

aa. Dorsal fins separate, the anterior highest.

#### 1166 (b). C. marmoratus Steindachner.

Golden brown, marbled with grayish brown; two faint brown crossbands on head; six on body, the latter extending on dorsal and anal; lower side of head, pectorals, ventrals, and caudal with numerous narrow dark cross-bands; dorsal with two small sky-blue occllated spots, surrounded by black in the two posterior dark cross-bands. Body comparatively deep, compressed, the back somewhat arched; head pointed; month large, the maxillary extending to behind the eye, more than half length of head; opercle with a sharp spine; jaws equal; teeth pointed, in narrow bands, the outer larger; vomerine teeth in one row; supraocular tentacle small, about as large as nuchal tentacle; no nasal tentacle. Pectoral a little shorter than head. Dorsals separate, the second spine of first dorsal  $\frac{2}{3}$  length of head, higher than second dorsal, the spines of which are about half head. Head  $4\frac{2}{5}$ ; depth  $4\frac{2}{5}$ . D. III-XXVI, 1; A. II, 20; Lat. l. 38. L.  $2\frac{3}{4}$  inches. (Steindackner.) Florida Keys (Bean) to Cuba.

(Steindachner, Iehth. Beitr. v, 174, pl. xii, f. 6, 1876.)

Page 774. No. 1181 should stand as

1181. C. violaceus Grd., instead of "(Ayres) Grd."

Page 793. After *Ophidium holbrooki* (which will probably be found to be identical with *O. josephi*) add:

# 1221 (b). O. gračilsi Poey.

Pale olive (fins without dark edging?). Head small, not very blunt; snout  $4\frac{2}{3}$  in head; eye  $3\frac{1}{4}$ ; month oblique, the maxillary 2 in head, reaching to posterior border of pupil; teeth small, in narrow bands, few on vomer and palatines; head naked; snout without spine; gill-rakers rather long and strong, 4 below angle of arch; opercle without spine; occiput nearly midway between origin of dorsal and front of eye. Airbladder long and slender, tapering backwards. Head  $4\frac{2}{3}$ ; depth 7. Cuba to West Florida.

(? Poey, Memorias Cuba, ii, 455, 1860; Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 301.)

Page 794. After Ophidium profundorum add:

# 433 (b).-GENYPTERUS Philippi.

(Philippi, Wiegmann's Archiv. 1857, 268: type Genypterus nigricans Philippi = Conger chilensis Guichenot.)

As here understood, this genus differs from *Ophidium* chiefly in the presence of a sharp spine on the operele; most of the species have some of the palatine teeth enlarged. ( $\gamma z \nu v z$ , chin;  $\pi z z \rho v v$ , fin.)

a. Palatine teeth small.

#### 1223 (b). G. omostigma J. & G.

Light olive, mottled with darker; fins with broad black edging; a large round, intensely black spot at the shoulder, rather larger than pupil; upper half of eye black. Body rather short, tapering rapidly backward from the occiput; snout blunt; mouth horizontal; lower jaw included; maxillary not quite reaching posterior border of orbit, 1½ in head; teeth in jaws in broad bands; teeth on vomer and palatines quite small; eye much longer than snout, 3 in head; opercle ending in a strong spine; gill-rakers very small, 4 below angle of arch. Ventrals half length of head; scales minute, imbedded, irregularly arranged; no evident pseudobranchiæ. Air-bladder short, thick, with a large posterior foramen. Head 4½; depth 6. L. 3½ inches. Deep water off Pensacola, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mns. 1882, 301.)

Page 796. For *Halias* Ayres read *Brosmophycis* Gill. The former name is said to be preoccupied.

Page 810:

# Family 120 (b).—CHIASMODONTIDÆ.

We are indebted to Professor Gill for the following note on the relationships of *Chiasmodon*:

"The genus *Chiasmodon* has no affinity with the *Gadidw*, but is nearly related to some forms included by Dr. Günther in the heterogeneous group designated as the family *Trachinidw*. It should apparently be isolated as the type of a peculiar family, which may be provisionally defined as follows:

"Acanthopterygians with a short first dorsal of slender spines; a long second dorsal and anal; ventrals normal (I, 5) and thoracie; mouth very deeply eleft; upper jaw not protractile, covered by an integument in common with the snout anteriorly; the opercular apparatus very oblique and reduced.

"This family is perhaps as nearly allied to the Chanichthyida as to any other." (Gill MSS.)

Page 816. Instead of Citharichthys aramaca read:

1256. C. pretulus (Goode & Bean) J. & G.

Instead of the synonymy in the text read:

(Hemirhombus patulus Goode & Bean, Proc. U. S. Nat. Mus. Phila. 1882, 414.)

The known specimens are from Pensacola, Florida.

After Citharichthys pætulus add:

1256 (b). C. occilatus (Poey) J. & G.

Light brownish; head, body, and fins everywhere finely mottled and blotched with whitish and dusky. Body moderately elongate. Mouth small, very oblique, the maxillary extending to opposite middle of eye, its length  $2\frac{1}{2}$  in head. Teeth rather small, unequal, some of the upper almost canine like, in two rows above and one below; eye 4 in head; interorbital area rather broad, concave, its width  $\frac{2}{3}$  length of eye. Dorsal rather low, its anterior rays beginning on right (blind) side. Caudal rounded, its length  $\frac{4}{3}$  head; left pectoral filamentous, nearly as long as head. Ventrals short, the left ventral on abdominal ridge. Lateral line without curve. Accessory scales greatly developed (as in the genus *Platophrys*, which this species much resembles). Head  $3\frac{5}{6}$ ; depth  $2\frac{1}{3}$ . D. 88; A. 70; Lat. l. about 60 (pores of blind side).

(Hippoglossus occilatus Poey, Mem. Cuba, ii, 314, 1860: Hemirhombus occilatus Poey, Syn. Pisc. Cub. 407:? Hemirhombus aramaca Günther, iv, 422.)

Page 817. After Citharichthus sordidus add:

### 1257 (b). C. stigmæns J. & G.

Olivaceous, the scales darker edged; fins dusky; all the vertical fins with a small round inky spot near the middle of each seventh to tenth ray. Body rather deep, strongly compressed; caudal peduncle short and deep; mouth moderate, the maxillary  $2\frac{3}{4}$  in head, reaching past front of pupil; teeth very slender, rather long, uniserial, about  $\frac{40}{30}$  on each side. Eyes large, separated by a sharp, scaleless ridge; gill-rakers moderate. Fins moderate; caudal about as long as head; pectoral  $1\frac{2}{5}$  in head. Head  $3\frac{3}{4}$ ; depth  $2\frac{1}{5}$ . D. 87; A. 68; Lat. l. 54 (pores). Santa Barbara, California.

(Jordan & Gilbert, Proc. U. S. Nat. Mns. 1882.)

Page 841. After Monolene sessilicanda add:

#### 463 (b).-BÆOSTOMA Bean.

(Bean, Proc. U. S. Nat. Mus. 1882, 413: type Baiostoma brachialis Bean.)

This genus is distinguished from Achirus by the presence of a pectoral fin on the eyed side. From the European genus Monochir it differs in having the right ventral connate with the anal. (βαιος, small; στόρω, mouth.)

### 1298 (b). B. brachiale Bean.

Grayish, with 5 or 6 faint dark vertical lines, and with a few scattered white spots, the largest nearly as large as eye; blind side whitish. Pectoral of right side present, of several rays,  $\frac{2}{5}$  length of head; right ventral of 5 rays, continuous with anal. Scales of nape, chin, and breast, much enlarged and spinulose. Interorbital width half eye. Caudal as long as head. Head more than 3; depth nearly half of total length. D. 47; A. 35. South Florida. (Bean.)

(Bean, Proc. U. S. Nat. Mns. 1882, 413.)

Page 845. The type of *Pterophrynoides* is *Lophius histrio* Linn., not *Chironectes bougainvillii* as stated in the text.

Page 853. After Ostracium trigonum add:

#### 1316 (b). O. triquetrum L.

Dusky, closely covered with round dark spots. Body three-angled, the angles rather sharp. No spines anywhere. Carapace closed behind dorsal. Snout somewhat concave in profile. Supraocular ridges prominent, the space between them concave. Head 4; depth 2½. D. 10; A. 10; Lat. l. 9. West Indies, north to Pensacola.

(Ostracion triqueter L. Syst. Nat.; Günther, viii, 256.)

Page 856. Instead of Monacanthus broceus read:

1322. M. hispidus (Linn.) J. & G.

(Balistes hispidus Linn, Syst. Nat.)

Page 861. After Tetrodon turgidus add:

1322 (b). T. nephelus Goode & Bean.

Very close to *T. turgidus*, of which it is the southern representative. Back and sides with pale spots, which are often surrounded by dark reticulations; dark bars on sides fainter than in *T. turgidus*, the axillary bar scarcely darker than the others. Spines of upper parts much larger, farther apart, and more distinctly stellate, than in *T. turgidus*, ceasing opposite front of dorsal and vent; less than 40 in a series from eye to dorsal. Dorsal rather larger than in *T. turgidus*. D. 8; A. 6. Georgia to Texas; very abundant. Perhaps a variety of *T. turgidus*, but thus far readily distinguishable.

(Goode & Bean, Proc. U. S. Nat Mus. 1882, 412.)

Page 863. Instead of Diodon novemmaculatus read:

12.16. D. liturosus Shaw.

(Shaw, General Zoölogy, v. pt. 2, 436, 1804; after Lacépède.)

Page 864. After Chilomyeterus geometricus add:

1337 (c). C. reticulatus (L.) Gthr.

Body and fins mostly covered with small round black spots; a large black blotch before and around dorsal; another on each side above gill-opening and pectoral. Spines short, compressed, the anterior root flat, much longer than the other roots except anteriorly; supraocular cirrus well developed. Head  $2\frac{2}{3}$ ; depth  $2\frac{2}{3}$ . D. 12; A. 12. West Indies, north to Florida Reefs.

(Diodon reticulatus L. Syst. Nat.; Günther, viii, 313.)

Page 865. After Mola rotunda add:

#### 487.-RANZANIA Nardo.

(Nardo, Ann. Sci. Regn. Lombard. Venet. 105, x, 1840: type Tetrodon truncatus Retz.)

Body oblong, the depth about half the height; skin smooth, tessellated, divided into small hexagonal scutella; otherwise essentially as in *Mola*. (Dedicated to A. Camillo Ranzani.)

#### 1340. R. truncata (Retzius) Nardo.

Snout straight, the mouth being on the level of the eye; caudal

very short, its base straight, slightly oblique. Size much less than that of *Mola rotunda*. Pelagic: occasional off our Atlantic coast.

(Tetrodon truncatus Retz. Vet. Ak. Nya Handl. vi, 2, 116; Orthagoriscus oblongus Bloch & Schn. 1801, 511; Orthagoriscus truncatus Giinther, viii, 319.)

# Page 6:

# FAMILY BDELLOSTOMATIDÆ.

The genera *Heptatrema* and *Polistotrema* may be recognized as constituting a family (*Bdellostomidæ* Gill) distinct from *Muxinidæ*.

Page 12. We are indebted to Professor Gill for the following outline of a proposed subdivision of the *Squali*.

The existing *Squali* appear to be naturally divisible into four suborders, which differ, so far at least as the first three are concerned, in many important respects. They may be briefly diagnosed as follows:

#### I. OPISTHARTHRI OR CYCLOSPONDYLL

Squali with the palato-quadrate apparatus articulated or connected with the postorbital processes of the skull; the mouth inferior; branchial apertures in increased number (6 or 7); only one dorsal tin. The Notidanida alone exhibit these peculiarities in the existing fauna.

#### H. PROARTHRI OR ACRODONTA.

Squali with the palato-quadrate apparatus articulated by an extensive surface with the preorbital region of the skull; the mouth subterminal and the forchead declivous. The Heterodontidae are the only living representatives.

#### III. ANARTHRI OR GALEI.

Squali with the palato-quadrate apparatus not articulated with the skull; the dentigerous portions moderately developed; the month inferior. All the living sharks except the Squatinide, Heterodontide, and Notidanide belong to this suborder.

#### IV. RHINÆ.

Squali with the palato-quadrate apparatus not articulated with the skull; the dentigerous portion advanced forwards; the month terminal; and the pectorals with enlarged anterior basal lobes which are separated by notch-like spaces from the branchial region. The family of Squatinida is the only existing family of this suborder.

Page 22, etc. The following brief "key" will perhaps facilitate the identification of the species of *Carcharias*, which are at present known from our Atlantic coast:

- - b. Upper teeth oblique, deeply notched on outer margin. (Platypodon Gill.)
  - Obscurus.

    bb. Upper teeth triangular, subcrect, scarcely notelied on outer margin. (Eulamia Gill.)
    - c. Shout moderate, its length, from mouth, about equal to breadth of mouth.

CERELEUS.

cc. Snout very short, its length much less than breadth of mouth....PLATYODON.

Page 156. Professor Hay (Proc. U. S. Nat. Mus. 1882) distinguishes *Hybognathus argyritis* from the less common *H. nuchalis* by the following characters:

Page 160. After Hyborhynehus superciliosus add:

#### 80 (b).-TIRODON Hay.

(Hay, Proc. U. S. Nat. Mns. 1882: type Tirodon amnigenus Hay.)

Pharyngeal teeth 2, 4–4, 2, compressed, not hooked, and with a broad grinding surface; lower pharnygeal bones broad, sharply enrved. Otherwise as in Hybograthus. (τειρω, to wear away; ὁδούς, tooth.)

#### 194 (b). T. ammigemus Hay.

Yellowish green, silvery below; upper parts dotted with black; these dots forming posteriorly a dark streak along lateral line, and one along each side of anal; fins pale. Form and appearance of *Hybognathus argyritis*. Jaws thin, the lower slightly included; mouth small, rather oblique, the maxillary not reaching front of eye; eye 3 in head, equal to snout. Lateral line decurved, complete. Dorsal inserted slightly before ventrals, a little nearer base of caudal than snout; anal small. Head  $3\frac{1}{2}$ ; D. 8; A. 7; scales 5–38–3. Teeth 2, 4–4, 2, formed as in *Hybognathus*. Intestinal canal  $3\frac{1}{2}$  times length of body. L.  $1\frac{1}{4}$  inches. Pearl River, Mississippi. (*Hay*.)

(Hay, Proc. U. S. Nat. Mus. 1882.)

Page 261. Under *Elops saurus* the gular plate is about 3 times as *long* as *broad*.

Page 296. In Hyphalonedrus chalybeius the interorbital width is one-fourth the eye, not "4 times."

Page 297. Coregonus couesi is identical with Coregonus williamsoni, and may be suppressed.

Page 318. Salvelinus naresi seems to be indistinguishable from Salvelinus oquassa. It may therefore be erased.

Page 356. *Gymnothorax* Bloch & Schneider, is properly a synonym of *Muræna*. The oldest tenable name for the subgenus, called in the text "*Gymnothorax*," seems to be *Sidera\** Kaup.

Page 358 (899). The type of the genus *Ophichthys* Ahl is, according to Poey, *Muræna annulata* Ahl, which is a species of *Pisodontophis*. Genus 170 must therefore stand as *Murænopsis* Le Sueur, and 170 (b) as *Ophichthys* Ahl.

Page 362. Instead of Conger read:

### 174.-LEPTOCEPHALUS Gmelin.

The two species may stand as 588, L. conger (L.) J. & G. and 588 (b), L. candicula (Bean) J. & G.

Page 406. We are indebted to Mr. Joseph Swain for the following key to the species of *Menidia*:

- a. Scales more or less laciniate; soft dorsal and anal scaly.
- bb. Anal rays I, 19 to I, 21; D. IV-I, 7 or 8; Lat. 1, 50.........LACINIATA. aa. Scales entire; soft dorsal and anal naked.
  - c. Anal fin rather short, its rays I, 15 to I, 18; depth about 5 in length.
    - d. "Dorsal rays V-I, 11"...BERYLLINA.
      dd. Dorsal rays IV-I, 8 or I, 9.
  - ce. Anal fin rather long, its rays I, 22 to I, 25.

    - ff. Body elongate, its depth 6 in length; head 5...............Notata.

Page 413. The species of *Polynemus* have three anal spines.

Page 416. After Echeneis nauerates add:

# 206 (b).-PHTHIRICHTHYS Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1802, 239: type Echencis lineata Menzies.)

Dorsal laminæ only 10; palatines with sharp teeth; otherwise as in *Echeneis* proper.  $(\varphi\theta\epsilon i\rho$ , a louse;  $i\chi\theta\delta\epsilon$ , a fish.)

#### 657 (b). P. lineatus (Menzies) Gill.

Disk twice as long as broad, its length 4½ in body; lower jaw very narrow, much projecting. Head 5 in length. Body blackish, with two

<sup>\*</sup> Kaup, Apodes, 1856, 70: type Muræna pfeifferi Bleeker = Muræna pieta Ahl. (Latin sidus, a star, from the stellate spots in the typical species.)

whitish lateral bands; all the fins white-margined. D. X-33; A. 33. Tropical seas, north to South Carolina.

(Echeneis lineata Menzies, Trans. Linn. Soc. Lond. i, 187, 1791: Echeneis tropica Euphrasen, Nya Handl. 1791, 317; Echeneis lineata Günther, ii, 382: Echeneis apicalis and sphyranarum Poey, Mem. Cuba, ii, 254, 255.)

Page 433. The identification of the species of *Caranx* may be facilitated by the following key, which may be substituted for the analysis given in the text:

- a. Rays of soft dorsal I, 23 to I, 27; teeth subequal, or the outer a little enlarged.
  - b. Shoulder-girdle below with a fleshy projection, in front of which is a cross-furrow; body elongate; depth  $3\frac{1}{2}$  in length. (Trachurops Gill.)

CRUMENOPHTHALMUS.

- bb. Shoulder-girdle without peculiar appendage.
  - c. Maxillary broad; dorsal and anal usually more or less elevated anteriorly, or falcate: head large, more than + length.
    - d. Scutes 40 to 50. (Paratractus Gill.)
    - dd. Scutes (developed) about 30. (Carangoides Bleeker.)
      - f. Length of pectoral equal to depth of body, which is 3 in length....CIBL
- aa. Rays of soft dorsal I, 20 to I, 22; body deep; teeth of the outer row enlarged, sometimes forming feeble canines; sentes 30 to 35. (Caranx.†)

Hippos.

Page 443. No. 699 should be—

699. T. glaucus (Bloch) C. & V.

(Chatodon glancus Bloch, Ichth. vi, 76, pl, 210,)

Page 489. After Ammocrypta pellucida add:

# **762** (b) **A. vivax** Hay.

Pellucid; sides with 10 dusky blotches, most distinct posteriorly; 14 similar blotches along back; top of head speckled; fins with a few dots. Form of A. pellucida. Maxillaries reaching front of orbit; teeth rather weak; eye 3½ in head, equal to snont; cheeks and opereles scaly. Body covered with small, strongly etenoid scales, except the regions immediately before and behind bases of paired fins. Spinous and soft

<sup>\*</sup> Seember crysos Mitchill, Trans. Lit. & Phil. Soc. N. Y. I, 424, 1815 = Caranx pisquetus C. & V.

t = Carangus Girard. The proper type of Caranx is  $Scomber \ carangus$  Bloch  $= Scomber \ hippos$  L. The word Caranx (Carangue) is a corruption of the Portuguese name Acarauna.

dorsals about equal, their longest rays half head, about equal to the interspace between them. Anal short and high, half higher than long, its base not quite half head, its spine weak; pectorals and ventrals reaching a point midway between base of pectorals and anal. Head 4; depth 7. D. XI-10; A. I, 9; scales 6-65-10. L. 13 inches. Pearl River, Mississippi. (Hay.)

(Hay, Proc. U. S. Nat. Mus. 1832.)

Page 490. After Ioa vitrea add:

#### 761 (b). I. vigilis Hay.

Pellucid, with about 10 quadrate dark blotches along the back and as many along lateral line, the last 4 or 5 of these largest; a small distinct black spot at base of candal; head dusky above, its sides plain. Body slender, the caudal peduncle deep and compressed, twice as long as deep. Head long, pointed; mouth large, the jaws equal, the maxillaries reaching front of pupil; teeth recurved; opercular spine well developed. Head naked; eye large, 3 in head, longer than snout. Porsal fins similar, longer than high; anal longer than high, somewhat smaller than second dorsal, its spines slender, half as long as soft rays. Posterior portion of body densely scaled; anterior portion apparently with a few scales above lateral line, none below; lateral line not developed on the last 5 or 6 scales. Head  $3_4^n$ ; depth 6. D. N—12; A. II, 10; Lat. l. about 60. L.  $1_3^n$  inches. Pearl River, Mississippi. (Hay.) (Hay.) Proc. U. S. Nat. Mus. 1882.)

Page 494. Vaillantia chlorosoma is identical with V. camura.

Page 544. Instead of Priacanthus macrophthalmus read:

#### 858. P. arematus C. & V.

(Cuv. & Val. iii, 101, 1829. The original Anthias macrophthalmus Blech. is a different species.)

Page 549. Lutjanus blackfordi, the Red Snapper, seems to be identical with L. campechianus. It ranges southward to Aspinwall.

Pages 534, 553. The *Perca formosa* of Linn, is the *Serranus fascicularis* of C. & V., and not the *Diabasis formosus* of the text. The former should, therefore, stand as *Serranus formosus* (L.) J. & G. and the latter as *Diabasis plumieri\** (Lac.) J. & G.

Page 538 (918). The description of *Trisotropis brunneus*, on page 538, should be cauceled, the species not being known from our coast. To

<sup>\*</sup> Labrus plumieri Lacépède, Hist. Nat. Poiss. iii, 480, 1802.

the description of our species, *T. stomias* G. & B., on page 918, add: Head 3; depth 4; Lat. l. about 140. Body rather slender, compressed. Scales smooth, with many accessory scales.

Page 557. The second interspinal bone of the anal is enlarged and penshaped in the species of *Stenotomus* and *Calamus*. It is normal, and not pen-shaped, in the typical species of the groups called *Pagrus*, *Sparus* (*Chrysophrys*), *Pagellus*, as well as in *Diplodus*, *Archosargus*, and *Lagodon*.

Page 557 (929). Our suggestion, on page 929, that Argyrops Sw. should be substituted for Stenotomus, is premature. The species called Argyrops (spinifer, chrenbergi, auriga) bear a strong resemblance to Stenotomus caprinus, and according to Steindachner (Beitr. zur Kenntn. Fische Afrika's, ii, 3, 4, 1882) their anterior teeth are somewhat compressed. Professor Doderlein has, however, published (Giorn. Scienz. Nat. Econ. Palermo, xiv, 1879) photographs of the dentition of Pagrus chrenbergi C. & V., from which it appears that these teeth are really robust canines and not incisors. Dr. H. E. Sauvage, who has kindly examined the specimens of "Pagrus spinifer" in the Paris Museum, has lately informed us that the dentition of this species is essentially that of Sparus pagrus, and different from that of Stenotomus.

Page 559. The description in the text of *Diplodus caudimacula* was drawn from young specimens of *D. holbrooki*, which may, however, prove to be scarcely distinct from the true *caudimacula* of Cuba.

Page 560. Instead of *Pimelepterus* read:

#### 289.—CYPHOSUS Lacépède.

(Kyphosus Lac. Hist. Nat. Poiss. iii, 115, 1802: type Kyphosus bigibbus Lac. πυφος, gibbous.)

887. C. bosqui (Lac.) J. & G.

Page 630. Instead of Philypnus read:

#### 339.-GOBIOMORUS Lacépède.

(Lacépède, Hist. Nat. Poiss, ii, 589, 1800: type Gobiomorus dormitor Lac. = Platycephalus dormitator Bl. & Schn. 1801: Gobius; ὁμορος, adjoining. Gobiomoroides Lac. is not a synonym of Electris.)

Page 882. Instead of Parallehthys ophryas read:

#### 1265. P. ocellaris (Dek.) J. & G.

Cape Cod to Florida; generally common.

(Platessa occilaris Dekay, New York Fauna, Fishes, 1842, 300: Pseudorhombus occilaris Günther, iv, 430.)

Page 426. The dorsals in Scomberomorus concolor are contiguous, as in S. maculatus.

Page 438. Under No. 692, for "Akerly" read "Mitchill."

Page 447. Instead of Oligoplites oecidentalis read, 707. O. saurus (Bl. & Schn.) J. & G. (= Scomber saurus Bl. & Schn. 32). The original Gusterosteus oecidentalis L. (Syst. Nat. Ed. X) is not this fish, and is unidentifiable.

Page 519. Pacilichthys butlerianus is identical with P. barratti.

Page 534. Instead of Serranus trifurcus read, 837. S. philadelphicus (L.) J. & G. (= Perea philadelphica L. Syst. Nat. Ed. X).

Page 539 (918). Nos. 847 and 850 (c) should apparently stand as *Epinephelus impetiginosus* (Müller & Troschel) Poey, and as *Epinephelus apua* (Bloch) Goode & Bean, respectively. The prior names *punctatus*, atlanticus, and guttatus are of very doubtful application.

Page 553 (924). Instead of *Diabasis chrysopterus* read, 873. *D. aurolineatus* (C. & V.) J. & G. The original *Percu chrysoptera* L. is some other fish, probably unidentifiable.

Page 603 (936). No. 946 (*P. radiatus* of the text) should stand as *Platyglossus eyanostigma* (C. & V.) Gthr., while No. 947 (*bivittatus*) should be *P. radiatus* (L.) J. & G. The latter species is the original *Sparus radiatus* L.

Page 605. Instead of *Xyrichthys vermiculatus* read, 951. *X. lineatus* (Gmel.) J. & G. (*Coryphæna lineata* Gmelin, Syst. Nat. 1195). No. 952. *X. lineatus* C. & V. should be omitted, as not found on our coasts.

Page 616. Under Pomaeanthus arcuatus read:

D. X, 29; 65 scales between scapula and caudal; 85 to 90 in a series above lateral line.

Page 690. The "Northern variety" of *Ieelus notospilotus* seems to be a distinct species—*I. fenestralis* Jor. & Gilb.—It has a small pore behind fourth gill.

Page 916. The generic name *Brachyrhinus* is preoccupied. For it may be substituted:

#### 273 (b). PARANTHIAS Guichénot.

(Guichénot, Ann. Soc. Linn. Maine-et-Loire, x, 1868: type Serranus furcifer C. & V.)

Page 945. To the account of Gobius encoomus add:

Head 4; depth 5\(\frac{3}{4}\). D. VI-11; A. 12; Lat. 1. 37.

Page 104. Instead of Amiurus catus read, 98. A. nebulosus (Le S.) Gill. The Silurus catus L. is not this fish, and is not identifiable.

Page 358 (899, 969). The proper type of the genus Ophichthys Ahl. (De Murana et Ophichtho 1789) is Murana ophis L. The name Ophichthys should therefore be used as on page 358, for the species with sharp teeth. Those with granular teeth (Pisodontophis Kaup) should be called Ophisurus (Lacépède, ii, 195, 1800: type O. ophis Lac., nec L.). Our species snould stand as, 584 (b). Ophisurus acuminatus (Gronow) J. & G.

Page 440. The caudal peduncle in "Selene" setipinnis is armed as in Caranx, but more feebly.

Page 442. Instead of *Trachynotus ovatus* read, 697. *T. rhomboides* (Bloch) C. & V. (= *Chætodon rhomboides* Bloch, Ichthyol. pl. 209.) The true *T. ovatus*, from the East Indies, is thought by Liitken to be specifically different.

Page 532 \* No. 835 may stand as Polyprion cernium Val. Epinephelus oxygeneios is said to be a species of Oligorus.

Page 736. Instead of *Prionotus evolans* read, 1126. *P. sarritor* Jor. & Gilb.; and instead of subsp. *lineatus* read, 1126 (b). *P. strigatus* C. & V. *Trigla evolans* L. is not identifiable, and *Trigla lineata* Mitchill was an erroneous identification of *T. lineata* Bloch.

<sup>\*</sup>The corrections suggested on this page and the preceding have not been introduced into the table of contents.

	Page.		Page.
$\mathbf{A}.$		acutirostris (Acipenser)	86, 87
Abadejo	538	(Anguilla)	361
abbotti (Osmerus)	294	adamantinus	92,880
(Syngnathus)	384	adarondacus	317
Abeona	587	Adinia335.	
Abramis	249	adinia (Fundulus)	335, 801
acadian (Cottus)	685	adspersus	599
acadianus (Glyptocephalus)	838	æglitinus	803
(Hemitripterus	685	Elurichthys	110
Acantharchus	468	æneus (Centrarchus)	467
Acanthias	16	(Cottus)	701
acanthias	16, 17	(Pimelodus)	102
Acanthochætodon		ænigmaticus	620
Acanthocottus	700	a-pyptera	10
Acantholebius	641	æsculapins	888
Acanthonotus	370	a sopus	493
Acanthopteri	397	æstivalis (Ceratichthys)	216
Acanthopterygii	397	(Clupea)	267
Acanthosoma	865	(Gobio)	216
Acanthostracium	854	(Pomolobus)	267
Acanthuridæ	616, 880	Aëtobatis	50, 879
Acanthurus	617, 941	afer (Gymnothorax)	895
acervum	426	affine (Siphostoma)383,	904, 906
achigan	485	affinis (Atherinops)	409
Achirus	841	(Atherinopsis)	409, 410
achirus	842	(Carapus)	791
Acipenser	85	(Caulolatilus)	626
Acipenseridæ	84	(Clinostomus)	232
acipenserinus	730, 731	(Gambusia)	345, 346
ackleyi	878	(Gila)	229
Acomus	124	(lleterandria)	346, 894
acoupa	570	(Leuciscus)	232
Acrochilus	150	(Lucania)	343
Acronuridæ	616	(Syngnathus)	383
Acronurus	617	(Thynnus)	430
Actinochir	741	afra (Murana)	895
aculeatus (Chrysophrys)	557	agassizi (Acipenser)	87
(Clinus)	777	(Amphistichus)	592
(Gasterosteus)		(Chologaster)	325
(Halicutichthys)	851	(Hyperprosopon)	592
(Lophius)	851	(Pimephales)	159
(Sparus)		agilis	807
(Stichæus)	777	Agnus	628
acuminata (Muræna)	899	Agonidæ	
(Sciæna)	573	Agonus	728
acuminatus (Eques)	573	A gosia	208
(Grammistes)	573	aggregatus	590
(Ophichthys)	899	Aguja blanca	420
(Ophisurus)	899	Aguja de casta	420
(Pareques)	573	Aigrette	601
acuta (Myliobatis)	51	aigula	601
(Perca)	524	Ailurichthys	110

	Page.		Page.
ailurus	105	altus (Priacanthus)	545
alalonga	428, 429	alutaceus	150
alascanus	415	Alutera	858
alatunga	429	alutus	931
albaeora	429	Alvarius	514,522
albicauda	417	alveata	876
Albicore428,	429,430	alvordi	697
albidum (Moxostoma)	141	Δlvordius	500
albidus (Amiurus)	107	amabilis	195
(Gadus)	809	amara (Algoma)	156
(Ictalurus)	107	amarus (Hudsonius)	171
(Labrax)	530	(Hybognathus)	156
(Merlucius)	809	ambassis	558
(Pimelodus)	107	Amber-fish	444
(Ptychostomus)	142	Amblodon	567
(Tetrapturus)	420, 909	Ambloplites	466
albigutta	823	amblops	214
albirostris (Syngnathus)	906	Amblyopinæ	€30
(Corythroichthys)	906	Amblyopsidæ	323
Albula	258	Amblyopsis	324
albula (Mugil) 403,	404, 908	amblyopsis (Culius)	944
Albulidæ	258	amblyrhynchus431,	912, 970
albulus (Bryitus)	482	Ameiurus	102
(Lepomis)	481	americana (Lucioperca)	525
album (Hæmulon)	924	(Morone)	531
(Moxostoma)	139	(Morrhua)	804
Alburnellus		(Perca)	
Alburnops		(Raia)	41
Alburnus		(Scorpæna)	685
alburnus (Menticirrus) 577,		(Stilbe)	250
albus (Coregonus)	299	(Tautoga)	600
(Diabasis)	924	americanus (Abramis)	250
(Ptychostomus)	139	(Acanthias)	17
alectrolophus (Anoplarchus)	771	(Ammodytes)	
Alepidosauridæ	274	(Amphiprion)	532
Alepidosaurus		(Apogon)	
alepidotum (Gobiosoma)	638	(Apogonichthys)	564
alepidotus (Chætodon)	451	(Carcharias)	27
(Gobius)	638	(Cyprinus)	250
(Stromateus)		(Enchelyopus)	799
Alepocephalidæ	257	(Eques)	932
Alepocephalus	257	(Esox)	352
Alewife	267	(Hemitripterus)	685
Alfione	596	(Hippoglossus)	819
Alganea		(Histiophorus)	
Algoma	155	(Labrax)	551
aliciæ	238	(Leuciscus)	250
Alilonghi	428	(Leucosomus)	250
alipes	321	(Lophius)	844
Alligator-fish	730	(Luxilus)	250
Alligator Gar	92	(Notemigonus)	250
alliteratus	430	(Odontaspis)	28, 874
All-mouth	844	(Petromyzon)	11
Allosomus	301	(Phycis)	799
Alopecias	27	(Plargyrus)	250
Alopias	27	(Pleuronectes)	837
Alopiidæ	26	(Roccus)	530
Alosa	267	(Sqnalus)	28
alosoides		(Stilbius)	250
alta (Cliola)	163	amethystinus	317
alternans	938	Amia	94, 563
altipinnis	195	amia (Caranx)	911
altivelis	618	Amiatus	94
altus (Bub.lichthys)		Amiidæ	92
(Hudsonius)	164	Amitra	739
	401		

	Page.		Page.
Amiurus	102, 881	Antennarius	845
Animocœtes9,	867, 868	antiens	246
Ammocrypta	488, 970	antillanus	551
Ammodytes	414, 909	antiquorum (Hippocampus)	386, 906
Ammodytidæ	414	(Pristis)	37,875
amnigenns	968	antistius (Chænobryttus)	467
Amphiodon	260	antoniensis	105
amphiodon	260	Apeltes	396
Amphioxus	3	apeltes (Gasterosteus)	396
Amphistichus	1	Aphoristia	842
amplus		Aphredoderidæ	460
ampullaceus	365	Aphredoderus	460
Anableping	327	•	476
-		apiatus	
Anacanthini		apicalis	970
Anacanthini pleuronectoidei	813	Aplesion	514
anagallinus	479	Aplocentrus	880
anale (Ditrema)	591	Aplodinotus	567
analis (Amphistichus)	591	Apocope	209
(Centridermichthys)	717	Apodes	354
(Hyperprosopon)	591	Apodichthys	769
(Hypocritichthys)	591	Apogon	<b>563, 93</b> 0
(Oligocottus)	717	Apogonidæ	563
(Orthagoriscus)	866	Apogonichthys	931
(Saurus)	889	Apomotis	472, 473
analogus	939	apos	766
analostana	179	appendiculatus	381
Anarrhichadidæ	754	appendix (Ammocætes)	867, 868
Anarthichas	781	(Labrus)	480
Anarrhichthys	782	(Petromyzon)	868
Anarthri	967	(Pomotis)	
anceps	506	Aprion	24
Anchisomus	860	aprion (Diapterus)	935
Anchovy		(Gerres)	935
Ancylopsetta		Aprionodon	24, 874
Angel-fish		apua	
Angel Shark	35	apus	766
angelus	35	aquilensis	
Angler	844	-	816
anglorum	747	aquosus	309
Angnilla	361	aræopus	127
	361		
anguilla (Muræna)		aramaca	
anguillaris (Blennius)		Archoplites	465
(Enchelyopus)	784	Archosargus558,	
(Lumpenus)	777	aretica (Liparis)	
(Stichieus)	778	arctifrons (Calamus)	927
(Zoarces)	784	(Citharichthys)	818
Auguillida	357	Arctozenus	278
Anisarchus	776	areuatum (Ditrema)	592
Anisotremus		(Hæmulon)	553
anisurum		(Hyperprosopon)	592
anna:	727	arcuatus (Amphistichus)	591
annularis (Julis)	602	(Chætodon)	
(Pomoxys)	464	(Pomacanthus)	616
annulata (Melanura)	350	areturus	319
annulatus (Antennarius)	846	ardens (Catostomus)	128
anomala (Dekaya)	626	(Hypsilepis)	198
anomalım (Campostoma)	149	(Minnilus)	198
anomalus (Caulolatilus)	625, 626	ardesiaca (Gila)	235
(Rntilus)	148, 149	ardesiacus (Lepomis)	480
Anoplagonus	724	(Squalins)	235
Anoplarehus	770	arenatus (Priaeanthus)	971
Anoplopoma	649	(Rhiniehthys)	
anoplus		arge (Alburnellus)	202
Antaceus	85	argentata (Couchia)	797
Antennariidæ	845	(Motella)	797
Bull. Nat. Mus. No. 16-		, , , , , , , , , , , , , , , , , , , ,	.51
Dun, Mat. Mus. M0, 10-			

	Page.		Page.
argentatus (Astyanax)	255	Asternopteryx	769
(Plargyrus)	187	astori	8, 57
(Tetragonopterus)	255	Astronesthes	287
argentea (Hypsiptera)	798	Astroscopus	628, 941
(Sclene)	439, 440	Astyanax	255
(Sphyræna)	411	Atheresthes	820
argenteum (Ditrema)	593	Atherina	405
(Hyperprosopon)	592	Atherinichthys	406
argenteus (Ammocœtes)	10	Atherinidæ	404
(Amphistichus)	593	Atherinoides	406
(Eucinostemus)		atherinoides (Chriodorus)	903
(Gerres)		(Notropis)	202
	936	Atherinops	409
(Holconotus)		Atherinopsis	409
(Ichthyomyzon)	10	•	
(Leucisens)	222	atkinsii	395
(Pagrus)	556	atlanticus (Elacate)	419
(Petromyzon)		(Epinephelus)	
(Sparus)	556	(Megalops)	887
(Tetragonopterus)	255	(Sparus)	540
Argentina	295	Atractoperea	535
argentissimus	253	Atraetoscion	
argentosa	157	Atractosteus	92,880
Argyrea	406	atraria (Perca)	534
argyreiosus	223	(Siboma)	886, 887
Argyreus	206	atrarius (Centropristis)	534
argyreus (Fario)	307	(Pimelodus)	105
Argyriosus	439	(Serranus)	533, 916
argyriosus	222	(Squalius)	241, 886
argyritis		atricauda	842
argyroleuca	571	atrilatus340	892, 894
Argyrops		atripes (Ditrema)	595
argyrops		(Lythrurus)	197
argyresoma (Embiotoca)	597	(Minnilus)	197
Argyrosomus	300	atripinnis (Arlina)	496
argyrosomus (Damalichthys)	597	(Goodea)	348
Argyrotænia		(Ulocentra)	495
ariommus	194	atromaculata (Estrella)	492
Ariopsis	110	atromaculatum (Boleosoma)	492
Arius		atromaculatus (Cyprinus)	221
Arlina	491	atronasus (Rhinichthys)	
		-	771
arlingtonia		atropurpureus	662
armatus (Aspidophorus)		atrovirens.	293
(Centridermichthys)		attenuatus	
(Leptocottus)		Auchenopterus	764
artedi		auctorum	555
Artedias	689	audens	
artesiæ	516	auliscus	
arundinaceus		Aulorhyuchidæ	391
Ascelichthys		Aulorhynchus	
asper (Centridermichthys)		Aulostoma	390
(Cottopsis)		Aulostomatidæ	390
(Cottus)	695	aurantiacus (Balistes)	858
(Hexagrammus)641	, 643, 949	(Ceratacanthus)	858
(Pleuronectes)	835	(Cottogaster)	505
aspera (Limanda)	835	(Hadropterus)	505
aspera (Uranidea)	694	(Hypohomus)	505
Aspicottus	710	aurata (Cliola)	175
Aspidophoroides	724	(Moniana)	175
Aspidophorus	728	auratus (Carassius)	255
asprella	490	(Cyprinus)	253
asprigenis (Pœcilichthys)		(Gadus)	804
aspro	501	(Mullus)	931
Astatickthys		aurea (Clupea)	270
asterias (Blennius)		aureolum (Moxostoma)	140
(Mustelus)		aureolus (Catotomus)	140

Page.		Page.
478	Bashaw	102
444	Basiliehthys	406
867, 868	Basking-shark	30
-		
1		821
		549
)		
		622
	•	619 750
		484
		69
		5, 867
925, 973		967
588	beadlei	109
127	beani (Ammocrypta)	489
315	(Caranx)436,	912,970
315	(Limanda)	835
549, 550	(Pleuroneetes)	835
154	beekwithi	176
		345
1		212
- 1		
		$\frac{199}{372}$
		909
		344
0.11, 0.00		366
	-	696
636		910
464	berlandieri	403
885, 886	bernardini	128
965	Berycidæ	457
578		
		246
		868 $246$
	•	246
1		237
	· · · · · · · · · · · · · · · · · · ·	237
		307
570		162
926, 927	Big-eye	544
902	Big-eyed Herring	260, 261
902	Big-eyed Scad	434
645		212
. 854		161
		809
		834 834
		555
		177
		720
. 400		
. 727	bimaculata (Etheostoma)	500
-	bimaculata (Etheostoma)bimaculatus (Chætodon)	500 940
727 42 410	bimaculata (Etheostoma)bimaculatus (Chætodon) (Pseudoxiphophorus)	940 344
727 42	bimaculata (Etheostoma)bimaculatus (Chætodon)	940 344 940
	444 867, 868 270 483 340 340 443 670, 671 542, 920 478 477, 478 477, 478 477, 478 485, 886 965 611, 939 6464 885, 886 965 578 316 965 257 812 320 320 925, 966 965 570 926, 927 905 902 902 902 902 902 902 902 902 902 902	478

	Page.		Page.
binoculata	43, 878	bombifrons	
bipinnulatus	446, 913	bonariensis	445, 913
birostris52	2, 53, 880	bonasus	116
bison (Aspicottus)	710, 711	Bone-Dog	16
(Carpiodes)	119	Bone-fish	258
(Enophrys)	710	Bonito	
(Ictiobus)	883	Bonnet-headed Shark	
	396	1	
bispinosus (Gasterosteus)		Bony-fish	269
(Myliobatis)	51	boops	436
bisus	425	borea (Lucioperca)	
bivittatus (Hybopsis)	196	borealis (Alepidosaurus)	276
(Labrus)	937	(Amiurus)	108
(Minnilus)	195	(Arctozenus)	278
(Platyglossus)	936, 973	(Caulopus)	276
Black Angel	941	(Læmargus)	15
Bass	484	(Maurolicus)	
Black-fin	301	(Notorhynchus)	34
		, , ,	
-fish		(Paralepis)	278
blackfordi549,		(Pimelodus)	
Black Grouper	538, 540	(Scopelus)	
Grunt	553	(Sphyræna)	411
Horse	120, 121	(Sudis)	278
Black-nosed Dace	206	Boreocottus	706
Perch	595	Boreogadus	807
Sea-Bass		Borer	5
Blacksmith	611	boreum (Stizostedium)	
Black Sturgeon			
	87	boreus (Esox)	353
Blakea	763	bosei (Atherina)	
blanchardi	761	(Gobiosoma)	948
Blanquillo623,	625,626	(Gobius)	638, 948
Blennicottus	717,718	(Leuciscus)	250
Blenniidæ	753, 880	(Menidia)407, 908	, 909, 969
blennioides	497, 502	(Pimelepterus)	561
blennioperca	497	(Seriola)	445, 913
Blenniops	765	bosqui (Cyphosus)	972
*			
Blennius		bosquianus	
blennius (Alburnops)		bostoniensis (Anguilla)	
(Minnilus)	193	(Catostomus)	
Blennophis	756	(Muræna)	
Blenny	753,759	Bothragonus	
Blepharichthys	438	Bothrolæmus	441, 442
Blepharis	438	Bothus	815
Blepsias	719	boucardi	246
Blind Cat	102	bouvieri	315
Blind-fish	323	bovinus	
			94
Blob.	696	Bow-fin	
Blower	861	bowmani	187
Blue-back	267	braehiale	
-back Salmon	308	brachyacanthus	881
-back Trout	318	Brachyistius588	, 589, 936
Blue Cod	646	Brachyopsis	726, 955
Blue-fin	301	brachypoda	394
-fish 447, 448, 560,		Brachyprosopon	838
Blue Mullet	139	brachyptera (Echeneis)	417
			417
	594, 599	brachypterus (Remoropsis)	
Pike	,	(Thynnus)	429
Shark	22	(Zygonectes)	
Boccaccio	656	brachyrhynchus	86
Bodianus	541,602	Brachyrhinus	
bodianus (Cossyphus)	602	brachysomus	927
Boleichthys	514, 519	brachynrus	72
boleoides	699	Brama	455, 915
Boleosoma	491	Bramidæ	455
boleosoma (Gobins)	946	Branch Herring	267
holli	881	Branchiostoma	3.867

	rage.		rage.
Branchiostomatidæ,	2	bullaris	222
brasiliensis (Atherina)	408	Bull-head	
(Atherinichthys)	408	Bullon	938
(Esox)	902	Bull Trout	319
(Hemirhamphus)	902	Burbot	801
(Menidia)		burgall	599
(Mugil)	103	Burnstickle	395
(Narcine)	877	butlerianus	
(Torpedo)	877	Butter-fish	
Bream250,		Butterfly Ray	46
brevicauda (Pomoxys)	465	Bythites	795
(Salmo)	315	C	
breviceps (Pomotis)	478	C.	
(Ptychostomus)	141	caballa (Cybium)	427
brevipinna (Scymnus)	15	(Scomberomorus)	427
(Somniosus)	14, 15	eaballerote (Lutjanus)	92
brevipinne (Bolcosoma)	492	caballus	
(Ditrema)	589	Cabezon	714
brevirostris (Acipenser)	87	Cabrilla535	
(Carcharias)	61	Cæsiosoma	562
(Chasmistes)	132	Calamus555	
(Hippocampus)	386 909	calamus (Chrysophrys)	926
(Histiophorus)	61	(Pagellus)	926
(Hypoprion)	375	calcarata	952
(Scomberesox)	384	Calico Bass	465
(Syngnathus)	430	californica (Alausa)	266
(Thynnus)	70	(Morrhua)	806 35
brevis Brevoortia	269	(Squatina)	
Broad-shiners	449	californicus (Exocetus)	, 610, 611 379
broceus		(Gadus)	806
Brook Stickleback		(Hippoglossus)	821
Sucker	129	(Mustclus)2	
Trout	320	(Myliobatis)	0, 33, A10 51
brosme		(Paralichthys)	821
Brosmius	802	(Pseudorhombus)	821
Brosmophycis		(Stereolepis)	591
Brotulidæ		(Uropsetta)	821
broussoneti	576	californiense (Siphostoma)	
browni (Achirus)		californiensis (Atherinichthys)	409
(Atherina)		(Atherinopsis)	
(Hemirhamphus)		(Cyprinodon)	
(Solea)		(Ophisurus)	359, 898
(Stolephorus)		(Otolithus)	579
(Vomer)	440	(Scorpis)	562
hrunneus (Amiurus)	103	(Syngnathus)	384
(Serramis)	538	(Typhlogobius)	639
(Trisotropis)538		(Xenichthys)	
bryoporus	264	(Xenistius)	920
Bryttus		callarias (Gadus)	
Bubalichthyinæ	112	(Salmo)	
Bubalichthys115		Callechelys	897
bubalina	176	Calliodon	600
bubalis (Cottus)	701	calliodon (Liparis)	
bubalus (Amblodon)		eallipteryx	149
(Bubalichthys)		callisema	173
(Catostonius)		callisoma	
(lchthyobus)		callistia	
(1ctiobus)114		calliura (Codoma)	178
buccata		(Cyprinella)	
bucco		Calliurus	
Butfalo Cod		calliurus (Ioglossus)	
Butlalo-fish		callyodon (Cyclopterus)	
bufo		Calycilepidotus	
Bug-fish	269	calva	9-

	Page.		Pag	Α.
Camarina	560	earinatum (Acanthosoma)	_	65
campbelli	320	carinatus (Placopharynx)	142, 1	43
Campbellite	464	(Salmo)	3	15
campechianus		earminatus		12
camperi		carnatus		
Campostoma	148	carolina (Atherina)		
Campostominæ	145 370	(Trigla)		35
camtschaticus	868	carolina		
eamura (Boleosoma)	494	earolinensis (Gobius)		45 81
(Vaillantia)		(Seriola)		
eamurus (Nothonotus)	506	carolinus (Blennius)	,	60
(Pœeilichthys)	507	(Clinostomus)		33
canada (Elacate) 418,		(Gasterosteus)		42
canadense (Stizostedium)	526	(Pholis)		60
canadensis (Lucioperca)	526	(Prionotus)	7	35
(Salmo)	320	(Pteraelis)	4	55
Candle-fish	292	(Trachynotus)	4	42
eanieula	869	Carp	144, 2	54
caninus (Caranx)	438	earpio (Carpiodes)		18
(Lachnolæmus)	601	(Catostomus)118,		
(Pagellus)	927	(Cyprinodon)		30
canis (Galeus)	21	(Cyprinus)		54
(Mustelus)	20, 870 306	(Ictiobus)		83
(Salmo)(Squalns)	870	(Moxostoma)		39
Cantherines	858	Carp Sucker		
Capelin	291	earringtoni		09
eapeuna	554	caryi		
capillaris	439	eassidii		95
eapistratus	940	castaneus10,		
Capitaine	601	Cataphraeti	640, 7	24
capreolus539,	540, 918	eataphraetus (Agonus)	728, 9	56
eaprinus	929	(Cottus)	7	28
eapriscus	855	(Gasterosteus)		96
eaprodes		(Gasteracanthus)		96
Carangichthys	433	(Scaphirhynehus)		88
Carangidæ430,		eataractæ (Ceratiehthys)		07
Carangoides		(Gobio)(Rhiniehthys)		07
Carangops		(Leucosomus)		22
Carangus	437, 970	catenatus		2.a 37
(Scomber)		Cat-fishes		
Caranx		Catonotus		12
Carassius	253	Catostomidæ		12
earauno	541	Catostominæ	1	13
carbonaria (Pereina)	500	Catostomus	125, 8	83
(Pileoma)	500	catostomus (Cyprinus)	124, 1	2 <b>7</b>
carbonarius (Acipenser)	87	(Phenacobius)		06
(Gadus)	807	Catulus		69
(Pollachius)	807	catulus (Evorthodus)	,	
Careharias	,	(Gobius)		
carcharias (Carcharodou)(Squalus)	875	(Pimelodus)(Scylliorhinus)		04 69
Carchariidæ	27, 870	catus (Amiurus)	_	04
Carcharinus		(Serranus)		20
Careharodon	30, 875	eaudaeuta		97
Carelophus	765	eaudafurcatus		09
Careproctus		caudalis.		37
earibæum (Branchiostoma)	3, 57	caudata (Lamna)	23, 8	
earibæus (Diplodus)	930	eaudicula		
(Sargus)	930	caudimacula (Diplodus)		
caribbæa (Belone)	901	(Hæmulon)		25
earibbæus (Chloroscombrus)	441	(Sargus)		60
(Tylosurus)	901	Caularchus	7	48

	Page.		Page.
Canlolatilus	625	Channel Cat	107, 108
Canlopus	278	chantenay	4:
caurinus (Cyprinus)	225	Characini	11:
(Leucosomus)	225	Characinidæ	254
(Mylochilus)	224	Charioteer	54;
(Sebastes)	672	Charr	316
(Sebastodes)	672	charybdis	468
cavifrons (Ambloplites)	467	Chasmistes	131
(Hemitripterus)	686	Chasmodes	
eaxis		Chatoessina	270
cayuga	394	Chatoessus	271
Cebedichthyidæ	754	Charliedontida	284
Cebedichthys		Chanliodus	284
Centrarchidæ		Chairia Adam	846
	463	Cheilichthys	860
Centridermichthys	693	Chands	370
Centriscidae	387	Cheonda	799
Centriscus	388 527		
Centropomina		Chiasmodon	964
	778	Chiasmodus	810
Centroblennius	766	chickasavensis	185
Centropoids	533	chilensis	428
Centroprists	16	ehiliticus	191
Centroscymums	17	Chilomycterus	
centrura (Dasibatis)	67	Chilonemus	220
(Raia)48		Chimæra	54
(Trygon)		Chimæridæ.	50
centrurus (Dasyatis)	47	chinensis	390
cepedianum	271	Chinnook Salmon	306
Cephalaeanthus		Chiridæ	640
Cephalopterida:	52	Chirolophus	765
Cephaloscyllium	58, 59	Chironectes	84
cephalus (Semotilus)	221	Chiropsis	641
cerasinus	187	Chirostoma	406
Cerataeanthus	858	chirurgus	617, 94
Ceratias	847	Chirns	641
Ceratichtnys	211	chirus (Xiphister)	77:
Ceratiida	847	Chitonotus	691
Ceratocottus	710	chlora	169
Ceratoptera	52	chloris	441
cercostigma	193	chloristia	183
cerdale	790	chlorocephalus	190, 193
Cernier	532	Chloroscombrus	440
eernium	532	chlorosoma	494, 97
Cero	426	chlorostictus	668
cervinum	142	chlorurus	537, 918
cervus	711	Chœrojulis	60:
Cestracion	26	Chogset	599
Cestraciontidae	62	Chologaster	
Cestreus	579	Chondrostei	8:
Cetorhiuidæ	30, 31	Chondrostominæ	143
Cetorhinus	31, 875	chouicha	
Chenobryttus	467	Chriodorus	
Chænopsetta	821	Chriomitra	
Chatodipterus	613	Chriope	16:
Chetodon 614,		Chromides	608
chætodon (Mešogonistius)	471	Chromis	
(Pomotis)		chromis (Diabasis)	
Cha:todontidæchalcogrammus	614 807	(Hæmnlon)	
chalybæus (Minnilus)		(Perca)(Pogonias)	924 568
chalybeius (Hyphalonedrus)		Chrosomus	
chamæleonticeps	624	chrosomus (Minnilus)	
Channel Bass	571	chrysitis	191, 193
	311	(114 J 04 (10	10

	Page.		Page.
ch ysocephalus	186, 187	cirrhosus (Trachinus)	720
chrysochloris	266	Cirrostomi	2, 3
chrysogaster		Cisco	
chrysoleucus		Citharichthys	816, 964
chrysomelas		Clam Cracker	47
Chrysophrys		clarki (Catostomus)	130
chrysops (Caulolatilus)	626	(Fario)	313
(Labrax)	530	(Salmo)	315
(Latilus)	626	elathratus	535
(Ophichthys)		clavata	39
(Ophisurus)		claviger	711
· (Oxyodontichthys)	898	Clidoderma	831
(Perca)	530	Cliola	163, 169
(Roccus)	529	Clinocottus	717
(Sparus)		Clinostomus	
chrysopsis (Hyodon)		Clinus	761,962
chrysoptera (Perca)	553,973	clodalus	260
chrysopterum (Hæmulon)	553	Clupea	264,887
chrysopterus (Diabasis)	, 924, 973	Clupeidæ	262
chrysos (Carangus)	438	clupeiformis	299,301
(Caranx)	435	Clupeinæ	263
(Scomber)		clupeoides	300
chrysotus	342	Clypeocottus	710
chvysura (Sciæna)	933	Coachman	542
chrysurus (Chloroscombrus)	441	Coal-fish	806
(Dipterodon)	933	Cobbler-fish	438
(Lutjanus)	921	Cobia	418
(Mesopriou)	548	cobitis	163, 170
(Micropteryx)	441	coccineus	787
(Scomber)	441	coccogenis	188
(Sparus)	548	Cochlognathus	161, 884
chrysus (Caranx)	970	Cod-tish	
Chub220, 221, 235,		Codling	
Sucker	132, 133	Codoma163,	
chuss	799	Cœcula.	358, 897
cibarius	8	cœlolepis	17
cibi	912, 970	cornosus (Pimelodus)	105
cicatricosus	837	(Pleuronichthys)	
Cichlidæ	607	cœrulea (Cheonda)	242
Cigar-fish	912	(Cliola)	182
ciliaris (Chætodon)	615	(Codoma)	183
(Holacanthus)	615	(Etheostonia)	518
(Pomacanthus)	€15	(Meletta)	266
(Zeus)	438	cœrulescens	109
Ciliata	796	cœruleo-aureus	601
ciliatus (Bleunius)	784	cœruleus (Acanthurus)	617
(Epinephelus)	<b>6</b> 59, 950	(Carcharias)23,	
(Petromyzon)	8	(Carcharinus)	873
(Sebastodes)	,	(Ctenolabrus)	599
(Zoarces)	784	(Photogeuis)	183
cimbrius	797	(Pæcilichthys)	517
cinerea (Etheostoma)	509	(Squalius)	241
cinereus (Gerres)	935	cognata	698, 953
(Mugil)	935	Coho Salmou	307
(Nothonotus)	509	colias	424, 910
(Squalus)	34, 62	Coliscus	158
eingulatus (Pomacanthus)	616	collapsus	138
(Zygonectes)	342	colliei	54
(Fundulus)	342	Colocephali	355
cirratus (Squalius)	18	colonus	916
eirratum (Ginglymostoma)	18	coloratum	390
cirrhatus (Petromyzon)	5	comatus	381
Cirrhosomus	860	commersoni	
cirrhosum (Lepisoma)	762	communis (Catostonius)	130
cirrhosus (Blepsias)	719	(Leucosomus)	220

	Page.		Pag	ge.
communis (Pogonichthys)	-	Corsair		666
complanata	174	cornscans		278
compressa (Lota)	802	Corvina	931,	931
compressus (Engraulis)	274	Corynolophus		849
(Stolephorus)	274	Coryphæna	454,	914
concinnus (Amblodon)	568	Coryphanida		454
(Gasterostens)	394	Coryphanoides		81:
concolor (Ammocates)	10	Coryphopterus	634,	63.
(Chriomitra)	426	Corythrichthys		906
(Euschistodus)	611, 939	cosmopolita	440,	44)
(Glyphidodon)	611	Cossyphus		60]
(Pomacentrus)	611	Cottidæ		68:
(Scomberomorns)	425, 973	Cottogaster		497
conductor	443	Cottopsis	693,	69
Concy	541	Cottuneulus	687,	95:
confertus	159	Cottus	693,	700
continis (Pimelodus)	104	couchi (Dionda)		157
(Salmo)	317	(Pœcilia)		348
confluentus (Fundulus)	334	Couchia	796,	797
(Salmo)	307	couchiana (Limia)		348
conformis	237	(Pœcilia)		348
Conger 362,	900, 969	conesi (Apocope)		210
conger (Anguilla)	363	(Coregonus)	297,	968
(Leptocephalus)	969	(Prosopium)		297
(Muræna)	362	Couesius	:	218
Conger Eel	356, 362	Cow-fish		854
eongestum	138	Cow-nosed Ray		51
Congrogadidæ	790	Cow-Pilot.		611
conocephalus	225	Crab-eater		418
Conodon	550, 923	Craig-tlounder		838
conorhynehus	258	Cramp-fish		39
conspersns	239	Crappie		46
constellatus (Chiropsis)	646	crassicanda		246
(Chirus)	646	erassilabre	,	
(Sebastichthys)	666	crassus (Alvordius)		503
(Sebastodes)	665	(Squalius)		243
consuctus	309	craticula		893
sonus	141	Crawl-a-bottom		
convexifrons	478	Creek Fish		133
cookianus	461	Cremnobates		
cooperi (Cheonda)	242	crenulare		283
(Leuciscus)	242	Creolus		973
(Metoponops)	817	creolus		916
(Raia)	42, 878	Crevallé433,		
(Salmo)	309	eriniger		718
(Squalius)	242	crinitus		
copei (Leuciscus)	202	cristagalli (Anoplarchus)		77:
(Squalius)	238	(Cebedichthys)		774
Copelandia	469	Cristivomer		317
Copelandi	498	Croaker		
Copper-nosed Bream	479	croicensis		931
orallina	877	eromis (Labrus)		568
Coregonus296, 299,		crossotus		839
coregonus	139 429	Croalopsis		359 259
coretta	62	Crucian Carp		
cornubica		cruoreum (Xiphidium)		778
cornubica	325	crnoreus (Squalius)		23.
		Cryptacanthodes.		780
(Cyprinus)	180, 187	Cryptacanthidæ		75
(Hypsilepis)(Leuciscus)	187	cryptosus		45
(Laxilus)	187	Ctenolabrus		599
(Minnilus)		cubifrous		850
coroides	576	Cuckold		854
corondes	221	cuculus		
tor boratis	المنت	VUVHIUO		001

•	Pag	ge.		Page.
Culius	_	944	dalwigkii	801
Cultus Cod		646	Damalichthys	597
eumingi		213	damalis	119, 883
Cunner		599	Dasibatis	65, 879
cupreoides		105	Dasyatis	, 65, 879
cupreus		105	Dasybatus	879
curema		404	davidsoni (Pomadasys)	551
curilicus		723	(Pristipoma)	552
curtus		440	(Monacanthus)	€57
Cusk		802	decagonus	
cuspicauda		858	decagrammus	
cutisanserinus		120	Decapterus	432
Cut-lips			Decaptus	446
cuvieri			declivifrons	939
cyanellus (Apomotis)		473	declivis	912
(Ichthyobus)		114	decoratus	
(Lepomis)		473	decurrens	829
cyaneus		188	defensor Dekaya	438 625
cyanocephalus		608	dekayi (Gasterosteus)	393
cyanoguttatus.		267	(Isuropsis)	29, 874
cyanonoton		$\frac{207}{626}$	(Isurus)	29, 614 874
cyanops		603	(Phycis)	799
cyanostigma (Julis)			(Pimelodus)	105
· · · · · · · · · · · · · · · · · · ·		425	(Scomber)	424
Cycleptinæ		112	delicatissimus	274
		120	deliciosa	175
Cyclogobius		637	Delolepis	779
Cyclopterichthys		745	delphinus	122
Cyclopteridæ		744	Demoiselle	609
cyclopus		743	dentata (Pomatopsetta)	826
Cyclostomata.		3	dentatus (Hippoglossoides)	826
Cyclopterus	,	746	(Paralichthys)	822
cyclotis		212	(Pleuronectes)	822
Cylindrosteus		91	(Pseudorhombus)	823
Cymatogaster	588		dentex	294
cymatogramma		497	deprandus	353
Cynicoglossus		838	dermatinus	309
Cynocephalus		22	Dermatostethus	385
cynodon		921	desmarcstia	42
cynoglossus		838	Devil-fish	52
Cynoperca		526	Diabasis	923, 971
Cynoscion	579,	934	Diacope	547
cypho (Catostomus)		129	Diamond-flounder	830
(Esox)	:	352	diaphana (Hydrargyra)	334
Cyphosus		972	diaphanes (Raia)	41
Cyprinella163,	165,	176	diaphanus (Calliurus)	473
cyprinella	114,	883	(Fundulus)	334
Cyprinidæ		144	Diapterus	583
Cyprinodon	328,	894	diceraus	711
cyprinoides		887	diego	424
Cyprinodontidæ			difformis	
Cyprinus		254	digrammus	832 202
cyprinus119,			dilectus	
Cypselurus		380	dimidiatum	795
Cyttidæ		456	Dinematichthysdinemus	
D.			Diodon tacheté	863
Dace	221	230	Diodon	
Daddy Sculpin		702	Dionda	155
dactyloptera			Dioplites	484
Dactylopterinæ		732	diplæmius	197
Dactylopterus		737	Diplectrum	534
Dactyloscopus		<b>7</b> 53	Diplesion	496
Dallia		350	Diplesium	496

Page	в.		Page.
Diplodus	72	eglanteria	40, 41
dipterura48, 71, 8'		egregia (Tigoma)	236
Discoboli		(Gila)	239
discobolus	83	egregius (Squalius)	236
	41	Elacate	418
dissimilis (Ceratichthys)183, 215, 2	- 1	Elacatidæ	418
	18	Elagatis	446
	16	Elasmobranchii	12, 57
(Leucosomus)	- 1	elassodon	826
Ditrema		Elassoma	
	17	Elassomatidæ	
	23	Electric Rays	38
	- 1		<b>76</b> 3
Dog-fish		elegans (Blakea)	
		(Boleiehthys)	519
	19	(Cyprinodon)	329
	68	(Gibbonsia)	763
	41	(Diabasis)	923
	79	(Gila)	227
	51	(Hæmulon)	924
3	19	(Leuciseus)	228
	16	(Myxodes)	763
dolomieu (Micropterus) 4	85	(Nanostoma)	510
Dolphin	54	Eleotridinæ	630
dombeyi 57, 8		Eleotris	
domninus 203, 2	204	eleutherus	99
Doncella		elliotti	53
Dormitator	144	ellipticus	271
dormitator 631, 9	972	elongata (Clupca)	265
	972	(Gila)	232
Dorosoma	389	(Umbrina)	
Dorosomatidæ 2	270	clongatus (Benthodesmus)	910
Dory 456, 5	525	(Catostomus)	120, 121
dorsalis	913	(Clinostomus)	232
dorsatus 867, 8	68	(C yeleptus)	121
dorsomacula	560	(Lepidopus)	910
dovii 9	930	(Lepomis)	475
Drum	5 <b>6</b> 8	(Leuciscus)	232
drummond-hayi	540	(Luxilus)	232
drummondi (Otolithus)	34	(Ophiodon)	646
dubium (Campostoma)	150	(Osmerus)	295
(Exoglossum) 1	149	(Pleuronectes)	838
dubius (Ammodytes)	115	(Pomotis)	475
(Fierasfer)	791	(Sclerognathus)	121
Duck-bill Cat	83	(Sebastes)	669
ductor	143	(Sebastodes)	669
dugesi	106	(Squalius)	232
dulcis	885	Elopidæ	260
Dules 542, 9	920	Elops	261, 968
dumerili (Squalus)	35	emarginatus	549
duodecim	888	Embiotoca	594
duquesni	140	Embiotocidæ	585
Dussumieriinæ	263	Emerald-fish	635
dux	601	emiliæ	247
*		emorii	229, 230
<b>E</b> .		encæomus	945, 973
Eagle Ray 49,	50	Enchelycephali	354
earlli	708	Enchelyopus	796
	416	enchrysurus	940
and the second s	416	Engraulididæ	271
Echinorhinus 14,		Engraulis	272
	286	Enneacanthus	469
edentula	84	Enneacentrus	541
	354	Ennichthys	590
Ecl-pont		Enophrys	710
	493	ensis	

T 8	ige.		Pag	,e.
entomelas	660	Eutychelithus		68
Entosphenus	867	evansi	1	56
eos (Boleichthys)	521	Eventognathi	111, 8	82
(Chrosomus)	154	evides (Alvordius)		503
(Othonops)	639	(Clinus)	763, 9	162
(Pœciliehthys)	520	(Ericosma)	5	504
Ephippidæ	612	evolans (Exocetus)	3	378
Ephippus	613	(Halocypselus)	ä	377
Epicopus	809	(Prionotus)	7	735
16	2, 57	(Trigla)		736
	8, 57	Evorthodus		
Epinephelus539, 918, 919	, 920	exasperatus65		
episcopus	157	exilicauda		
Episema	193	exiliens	380,	904
Eques	932	exilis (Boleichthys)		521
equestris		(Belone)		374
equisetis		(Hippoglossoides)		827
erebennus	105	(Noturus)		100
eriarchus 469		(Pecilichthys)		521
Ericosma	503	(Tylosurus)		374
Ericymba	204	eximius		
Erimyzon	132	Exocœtus		
erinacea	40	Exoglosum		160
erochrous	520	F.		
Erogala		**		
Erythriuinæ	254	faber		613
erythrogaster (Chrosomus) 155		fabricii (Campylodon)		370
(Leuciscus)	154	(Centroscyllium)		16
(Luxilus) 155		(Cottus)		709
(Serranus)	540	(Gadns)		807
erythrurus	140	(Gunnellus)		778
eschrichti	848	(Liparis)		742
esculentus	438	(Lumpenus)		778
esmarki	786	(Macrurus)		811
Esmeralda	635	(Spinax)		16
Esocida	351	falcata (Seriola)		
Esox	352	falcatus (Carangops)		437
estor (Esox)		(Carany)		
(Gila)	233	(Labrus)		601
(Squalius)	232	(Lachnolæmus)		601
Estrella	491	(Trisotropis)		538
Etheostoma		fallax (Caranx)		
Etheostomatinæ	839	(Pomotis)		478 911
Etrumeus	263	(Trachurus)		222
Eucalia	394	Fall Herring		266
Euchalarodus		Salmon		306
Eucinostonius	583	Fario		312
Euctenogobius		fasciata (Seriola)		445
Eucyclogobius	637	fasciatum (Pristipoma)		551
Eugomphodus	27	fasciatus (Achirus)		841
Eulachou 29		(Alvordius)		504
Eulamia		(Bryttus)		470
Euleptorhamphus		(Catonotus)		513
Eumesogrammus	774	(Catostomus)		136
Eumicrotremus		(Centronotus)		767
Eupomotis		(Esox)		352
euryopa (Cliola)	171	(Diplesion)		505
euryops (Myxostoma)	140	(Grystes)		485
euryopus (Hudsonius)	171	(Gunnellus)		767
euryorus	481	(Larimus)		578
eurystoma	180	(Murænoides)		767
Eurystomus	880	(Pimephales)		158
Euschistodus	611	(Pogouias)	568,	569
Euthynnus	429	(Pomadasys)	551,	923

	Page.		Page.
fasciatus (Scomber)	446	fluviatilis (Algoma)	157
(Sebastes)		(Ammoeætes)	11
(Sebastodes)	652	(Hudsonius)	171
(Syngnathus)	383	(Hybognathus)	157
(Zonichthys)	446	(Lampetra)	
fascieularis 534,	, 535, 971	(Perca)	524
fasciolaris	676	(Petromyzon)	7
Fat-back	269	Flying fish	371, 378
Fat-head	158,602	Fly-fish	667
Father-lasher	701	Flying Gurnard	737
favosus	961	Robin	738
fecundus	129	fætens	280
feliuus	105	folium	83, 84
felis (Anarrhichthys)	783	fontinalis	320, 890
(Arius)	110,882	Fool-fish	856
(Mustelus)	20	forbesi	174
(Silurus)	110	formosa (Algausea)	
fenestralis	973	(Cliola)	175
ferox (Alepidosaurus)	276	(Limia)	347
(Atractosteus)	92	(Mollienesia)	
(Lepisosteus)	92	(Moniana)	
(Squalus)	874	(Perca)	
(Stomias)	286	(Uranidea)	955
ferrugineus	834	formosulum (Campostoma)	150
feuille (Polyodon)	83, 84	formosum (Hæmnlon)	559
Fierasfer	791	formosus (Alburnus)	185
Fierasferidæ	791	(Falliurus)	473
filamentosus (Hemirhamphus)	903	(Cottus)	
(Megalops)	261	(Diabasis)	553
(Phyeis)	.799	(Girardinus)	349
File-fish.		(Leuciscus)	245
fimbria	650	(Leucus)	245
fimbriatus	784	•	
	844	(Serranus)	071
Fishing-frog	389	forsterianus	127
		Four-eyed fish	940
Fistulariida		Fox-shark	27
flabellare	513	francisci	
flabellatus	513	franklini (Cottus)	699
flagellum (Raia)	50	(Pleuronectes)	837
(Saccopharynx)	365	(Uranidea) 699	
flammens	243	fratereulus	225
Flannel-mouth Cat	108	fremebundus	
Flasher	555	fremiuvillei	
flavescens (Bodianus)	524	frenatus	589
(Gadus)	803	Fresh-water Drum	567
(Perea)	524	fretensis	167
flavicanda	54 L	Friar	405
flavidus (Apodichthys)	769	Frigate Mackerel	424, 425
(Aulorhynchus)	391	frigida	174
(Schastodes)	657	Frog-tish.	845
flavipinuis	156, 884	frontalis	187
flavolineatus	561	Frost-fish	806
flavulus	332	fucorum (Apodichthys)	770
flavus (Noturus)	100	(Blennius)	759
Flesus	831	fulgida	252
Fliaum	662	fuliginosus (Balistes)	855
floridæ (Jordanella)	328	(Chilomyeterus)	864
(Siphostoma)	905, 906	(Diodou)	865
floridana (Cichla)	485	fulvomaculatus	
floridensis (Bryttus)	468	funduloides	233
(Calliurus)	468	Fundulus	
(Fundulus)	236, 891	furcatum (Ditrema)	596
floripinnis	339	furcatus (Aminrus)	109
Flounder 813,	822, 835	Furearla	611, 939
Flute-mouth	390	furcatus (Amiurus)	

	Page.		Page.
furcatus (Anthias)	534	gentilis 757, 758,	
(Cypselurus)	380	Genyonemus	574,932
(Exocœtus)	381	Genyoroge	547
(Ictalurus)		Genypterus	963
(Phanerodon)	596	geometricus	
(Pimelodus)	109 916	georgii	909 429
furcifer (Anthias)	916	germo	428
(Brachyrhinus) (Creolus)	973	Gerres	
(Pimelodus)	109	Gerridæ	582
(Serranus)	916	Ghost-fish	780
furciger	952	gibba (Liparis)	741
fürthi	923	gibber (Salmo)	305
fuscum (Siphonostoma)	383, 906	Gibbousia	763
(Siphostoma)	383	gibbosa (Cliola)	174
fuscus (Bythites)	795	(Gila)	239
(Hemirhombus)	817	(Lavinia) (Mouiana)	240 174
(Syngnathus)	383 726	(Perca)	483
fusiformis (Phalangistes)	520	(Tigoma)	239
(Beleggens)	520	gibbosus (Aphredoderus)	
(Boleosoma) (Hololepis)	520	(Catostomus)	134
(Pæcilichthys)	520	(Cyprinodon)	329,890
(2 comounts)		(Lepomis)	482
G.		(Lenciscus)	240
	794	(Pomotis)	480
Gađidæ		(Squalius)	239
GadusGaff-top-sail	111	gibbsi (Hemilepidotus)	715
Gaff-top-sail Pompano		(Salmo)gibbus (Hypsilepis)	315 187
Gaidropsarus	796	(Liparis)	741
gairdneri	313, 314	(Minnilus)	187
galactura	179, 180	gigas (Ephippus)	613
galeatus	709	(Seriola)	913
Galeocerdo		(Stereolepis)	561
Galeorhinidæ	18,870	Gila	227
Galeorhinus	21, 870	gilberti	959
Galeus	21	gilli (Lepomis)	468
galeus (Galeorhinns)2		(Xystroplites)	482
(Squalus)	21 438	Gillichthys	636 89
Galliehthys	438	Ginglymodi	18, 58
Gambusia		Ginglymostomatidæ	17, 57
gardeniana (Hiatula)		girardi	
gardenii (Sternoptyx)		Girardinichthys	342
(Stromateus)		Girardinus	348
gardoneus	249	Girella	560
Gar-fishes		Girellinæ	546
Garibaldi		Gizzard Shad	
Gar-pike		glaber (Cyclopterichthys)	745
Gar Pikes		(Platessa)	837
Garrupa539, 662		(Pleuronectes)	837 837
Gaspereau		glabra (Liopsetta)	283
GasterosteidæGasterosteus		glacialis (Cottus)	955
Gastrophysus.		(Gadus)	807
gavialis		(Pleuronectes)	837
gayi		(Scopelus)	283
gelatinosus		gladifer	421
gelida (Ammocrypta)	489	gladius (Histiophorus)	
gelidus (Ceratichthys)		(Scomber)	
(Gobio)		(Tylosurus)	
geminatus		(Xiphias)	
generosus	123	Glaniostomi	84

P	age.		Page.
Glass-eye	525	gracilis (Leuciscus)	187,220
glanca (Lamna)	29	(Lycodes)	787
(Oxyrhina) 29	9, 874	(Moniana)	175
glaucoframum	635	(Perca)	524
glancus (Carcharias)	2, 967	(Pimelodus)	109
(Carcharinus)	22, 60	(Platygobio)	219
(Chætodon)	1,970	(Pacilichthys)	521
(1suropsis)	874	(Ptychocheilus)	226
(Isurus)	8, 874	(Squalius)	237
(Squalus)	22	(Tigoma)	237
(Trachynotus)	2, 970	(Tilesia)	805
globiceps (Coryphæna)	455	(Uranidea)	699
(Oligocottus)	718	(Xiphopherus)	346
gloriosus	470	graciosus	109
Glossamia	564	graëllsi	963
Glut Herring	267	grahami (Gila)	228
glutinosa	4, 5	(Lenciscus)	229
Glyphidodon	610	(Oligocephalus)	517
Glyptocephalus	838	Grammatopleurus	641
Gnathanodon	433	Grammiconotus	374
Goat-fish	565	Grande Écaille	887
Goat's-head Porgee	929	grandipinnis	185
Gobiesocidæ.	747	grandis (Fundulus)	
Gobiesox 74		(Gila)	226
Gobiidæ	629	(Leuciscus)	226
gobioides (Cottus)	699	(Ptychochilus)	226
(Hypsicometes)	808	grandisquamis	
(Uranidea)	699	granulata	42
Gobiomoroides	4	Graodus	163
Gobiomorus		Grass Bass	465
Gobionellus		Gray Snapper	548
gobioninum	149	Trout	581
8		grayi	119
Gobiosoma		Grayling	302
Gobins			526
Goby		Gray Pike.	484
Goggle-eye	1	Green Bass	
Goggler	434	Conservation	806
Gold-fish	253	Green-fish	448
Golet	319	Greenland Halibut	819
gomesi	898	Green Pike	353
Goniodus	14	Sturgeon	86
Gonioperca	535	Grenadier	
Goodea	348	grex (Scomber)	424
goodei (Erimyzon)	134	Grindle	94
(Lucania)	343	grisea (Dionda)	155
(Ptilichthys)	369	(Lucioperca)	526
Goody	574	(Sciama)	568
Goose-fish	844	griscolineatum384,	
Gorbuscha	305	griseum (Stizostedium)	526
gorbuscha	305	(Carcharias)	28
goreensis 44	2, 912	griseus (Catostomus)	127
Goujon	102	(Mesoprion)	549
Gourd-seed Sucker	121	(Squalus)	62
gracile (Boleosoma)	522	grænlandicus (Cottus)	703,955
gracilis (Blennius)	779	(Gunnellus)	767
(Cottus)	699	(Himantolophus)	849
(Cyprinus)	220	(Hippoglossus)	820
(Gadus)	804	(Microstoma)	290
(Gila)	229	Gronias	102
(Gobins)	637	gronovii	449
(Gambusia)345, 34		Grouper	539
(Hybopsis) 21	, - 1	Grubby	701
(Lepidogobins)	637	grunniens	567
(Leptoblennius)	779	Grunt	553
(Leptogunnellus)	778		484
		•	

	Page.		Page.
Grystina	463	Halatractus	444
guacamaia	607, 938	Halecomorphi	92
guagnancho	411	Half-beak	376
Guasa	542, 920	Halias	795, 963
guasa	542, 920	Halibut	819, 821
guativere	541	Halichæres	602
gula (Diapterus)	935	Halieutæa	851
(Gerres)	934	Halientichthys	851
(Gila)	236	Haliperca	535, 917
(Squalius)	236	halleri (Urolophus)	46
gulonellus	220	Halocypselus	377
gulosa (Uranidea)	695	Haloporphyrus	800
gulosus (Centrarchus)	468	hamatus (Icelus)	
(Centridermichthys)	695	Hamlet	918
(Chenobryttus)		Hammer-head	130
(Cottopsis)	695	Hammer-headed Shark	25, 26
(Gobius)		hammondi (Percopsis)	323
(Lepidogobius)	945	(Pimelodus)	109
(Pomotis)		Hand-saw Fish	276
gunelliformis		Haplochilus	338
Gunnellops	766	Haploidonotus	567
Gunnellus	766	Haplomi	323
	767	Hard-head	313
gunnellus (Blennius)	31	Hard-mouth	150
guunerigunmisoni	176	Hard-tail	912
6		Hare-lip Sucker	
Gurnards		Harengula	268
guttata (Coryphæna)	914	harengulus	
(Perca)		'harengus (Coregonus)	301
(Scorpæna)	679	(Clupea)	265
guttatus (Astroscopus)	629	(Lavinia)	153
(Bodianus)	541	(Salmo)	301
(Chiropsis)	645	harfordi (Ptychochilus)	226
(Chirus)	645	Harpe	601, 936
(Euneacanthus)	471	Harvest-fish	
(Epinephelus)		hastata (Dasibatis)	48, 70
(Lampris)	453	(Pastinaca)	48
(Percopsis)	322	(Trygon)	70, 879
(Pomotis)	470	hastatus (Gobionellus)	636
(Sebastapistes)	680	Hayko	305
(Zeus)	453	Head-fish	
(Zygonectes)	341	hearnii	320
guttulata (Hypsopsetta)	830	beermanni	592
guttulatus (Hippocampus)	907	Heliastes	611
guzmaniensis		Helioperca	472
Gymuaeanthus	708	helleri	346
Gymnelis	789	Helmichthyidæ	362
Gymnodontes	859	Helops	85
Gymnothorax		helvomaculatus	667
gymnura (Trygon)	66	Hemdurgan	651
gymnurus (Gasterosteus)	395	Hemibranchii	387
gyrinus (Eleotris)	631	Hemilepidotus	714
(Noturus)	98	hemilepidotus	715
Gyropleurodus	32, 875	Hemioplites	469
		Hemirhamphus	
H.		Hemirbombus	
Haddo	305	Hemistoma	606
Haddock	803	Hemitremia	162
Hadropterus	505	Hemitripterinæ	683
hæmatura	166	Hemitripterus	685
Hæmulon	553	Hemitrygon	47
Hæmulum	554	henlei	
Hair-tail		henshalli	338
Hake	808	henshavii (Apocope)	210
	000		
Halælurus	58	henshawi (Salmo)	316

Page.	Page.
hentzi	holbölli
heptagonus	holbrooki (Diplodus)
Heptanchus	(Echeneis)
Heptatrema	(Eupomotis)
Heptranchias	(Gambusia)
Herichthys. 608	(Heterandria)
Heros	(Lepomis)
heros	(Ophidium)
Herpetoichthys	(Pomotis)
Herring	(Sargus) 559, 560
herschelii	Holeonotus
Heterandria	Holia
heteroclitus	11olocentrum
heterodon	Holocentrus
Heterodoutidæ	Holocephali
Heterodontus	Hololepis
Heterognathus	Holostei 88
Heterolepidina 640	Homalopomus 809
Heteropygii	homonymus
Heteroprosopon	Homoprion 570
Heterosomata 813	boodi 320, 321, 890
Heterostichus	Hoopid 307
heterurum	Hopladelus
hexacanthus	Hoplostethus 458
hexacornis (Cottus)	Horned Dace 221
Hexagrammus	Horned Pout
hexagrammus 644	Horn-fish 526
Hexanchidæ	Horny-head
Hexanchus	Horse Crevallé
hians 373, 901	Horse-fish 440
Hiatula	Horse-head
hiatula	Horse Mackerel
Hickory Shad	houghi 109
hieroglyphicus	Hound Sharks
hillianus 903	hoyi (Argyrosomus)
Himantolophus 849	(Coregonus)
Hind	(Uranidea)
hinnulus	hubbardi
Hipocempide         259           Hippocempide         385	hudsonia (Cliola)
	hudsonicus (Salmo)
Hippocampus         386, 906, 907           hippocampus         386	Hudsonius
Hippocephalus 723	127 
Hippoglossina	humboldti (Scopelus) 284
Hippoglossoides 825, 826	(Squalins) 234
hippoglossoides	(Tigoma)
Hippoglossus	humeralis (Cherojulis)
hippoglossus 819	(Julis)
hippops' 149	(Leiostomus)
hippos	(Oligocephalus)
hippurus 454, 914	(Platyglossus)
hippus 437	humilis (Bryttus)
hirudo 10, 868	(Cottus) 705
hirundo 712, 955	(Gambusia)
hispidus 966	(Lepomis) 479
Histiocottus	Humpback Salmon
Histiophorinæ	Huro
Histiophorus 421	huronensis
histrio845, 846, 965	Huso
hinlcus	hyalinus
Hoo 16	Hybognathus
Hog-fish	Hybopsis
Hog Molly	Hyborhynchus
Ilog Sucker	Hydrargyra
Holacauthus	Hydrolagus
Bull. Nat. Mus. No. 16——63	

	Page.		Page.
Hydrophlox	185	indicus (Notidanus)	34, 63
hydrophlox	233	(Tetrapturus)	909
Hylomyzon		inermis (Anoplagonus)	725
Hynnis	438	(Aspidophoroides)	725
llyodon	259	(Raia)	44
Hyodontidæ	259	(Sebastodes)	672
Hyostoma	496	ingens (Gunellus)	767
Hypeneus	565	(Hippocampus)	386 343
Hypentelium	130	innominatusinopinatus	395
Hyperistius	465 6	inornata (Lota)	802
Hyperoartia	4	(Raia)	878
Hyperotreta Hyperprosopon		inornatus (Apodichthys)	770
Hyphalonedrus		(Cryptacanthodes)	781
Hypleurochilus	758	inscriptum (Nanostoma)	512
Hypocritichthys		inscriptus (Nothonotus)	512
Hypohomus		(Pomotis)	478
Hypomesus		(Xenotis)	478
Hypoplectrus		insculptus	396
Hypoprion	59, 61	insigne (Pimelodus)	100
Hypoprionodon	61	insignis (Catostomus)	130
Hyporthodus	541	(Noturns)	100
Hypsagonus	722	insolatus	612
hypseloptera	184, 185	insulæ-sanctæ-crucis	938
Hypsilepis	185	integripinnis	764
Hypsicometes	808	intermedia (Tigoma)	238
hypsinotus		intermedius (Gasterosteus)	396
Hypsiptera	798	(Pomoxys)	465
Hypsopsetta	830	(Saurus)	889
Hypsurus	593	(Squalius)	238 889
Hypsypops	610	(Synodus)	530
Hysterocarpinæ	586	interrupta (Morone)	
Hysterocarpus	586	interruptus (Ambloplites)	460
Hysterocarpus	586 863	(Archoplites)	466
		(Archoplites)	466 165, 460
hystrixI.	863	(Archoplites)	466
hystrixI.  I.  Icelns	863 689	(Archoplites)	466 165, 466 923
hystrix  I.  Icelns Ichthælnrus	863	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys)	466 <b>165,</b> 466 928 928
hystrix  I.  Icelns  Ichthælurus  Ichthelis	689 107 472	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus)	466 465, 466 923 923 530 893
hystrix  I.  Icelns  Ichthælnrus  Ichthelis  Ichthyobus.	863 689 107 472 114	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus)	466 465, 466 923 923 530 893
hystrix  I. Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyomyzon	689 107 472	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus	466 465, 466 923 923 536 893 490, 971
hystrix  I. Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyomyzon Icichthys	689 107 472 114 9, 867	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus	466 165, 466 923 923 536 893 490, 971 948
hystrix  I. Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyomyzon	863 689 107 472 114 9, 867 621	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus. ionthas	466 165, 460 923 923 530 893 490, 971 948 960 948 464
hystrix  I. Icelns Ichthælurus Ichthelis Ichthyobus Ichthyomyzon Icichthys Icosteidæ	689 107 472 114 9, 867 621 619 620	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus iouthas ios irideus (Centrarchus) (Labrus)	466, 466, 466, 466, 466, 466, 466, 466,
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyopus Icichthys Icichthys Icosteidæ	689 107 472 114 9, 867 621 619 620	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo)	466 465, 466 923 923 530 530 592 490, 971 948 960 948 464 463 312
hystrix.  I.  Icelns Ichthelnrus Ichthelis Ichthyobus. Ichthyomyzon Icichthys Icosteidæ Icosteius Ictalurus.	863 689 107 472 114 9, 867 621 619 620 106, 881 466 113, 882	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola)	466, 466, 923, 530, 892, 490, 971, 948, 464, 464, 312, 172
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyomyzon Icichthys Icosteidæ Icosteidæ Icosteius Ictalurus ictheloides	863 689 107 472 114 9, 867 621 619 620 106, 881 466	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola) (Hypsilepis)	466, 466, 923, 530, 892, 490, 971, 948, 464, 464, 312, 172, 172
hystrix.  I. Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyomyzon Icichthys Icosteidæ Icosteidæ Icosteins Ictalurus ictheloides Ictiobus	689 107 472 114 9, 867 621 619 620 106, 881 466 113, 882 193 914	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola) ((Hypsilepis)	466, 466, 928 928 928 530 893 490, 971 948 960 948 464 464 312 172 172
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus. Ichthyobus. Ichthyopyzon Icichthys Icosteidæ Icosteidæ Icosteius Ictalurus. ictheloides Ictiobus. illecebrosus immaculata (Coryphæna) immaculatum (Cybium)	863 689 107 472 114 9, 867 621 619 620 106, 881 466 113, 882 193 914 427	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola) (Hypsilepis) (Leuciscus) Irish Pompano	466, 466, 922, 923, 530, 892, 490, 977, 948, 464, 464, 312, 1772, 221, 934
hystrix.  I.  Icelns Ichthelnrus Ichthelis Ichthyobus. Ichthyobus. Ichthyomyzon Icichthys Icosteidæ Icosteidæ Icosteins Ictalurus. ictheloides Ictiobus. illecebrosus immaculata (Coryphæna) immaculatum (Cybium) immaculatus (Salmo)	863 689 107 472 114 9, 867 621 619 620 106, 881 466 113, 882 193 914 427 320	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus iouthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita	466, 466, 466, 928, 928, 928, 892, 490, 971, 946, 464, 464, 312, 172, 172, 221, 934, 615
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyobus Ichthyopyzon Icichthys Icosteidæ Icosteidæ Icosteidæ Ictalurus ictheloides Ictiobus illecebrosus immaculatu (Coryphæna) immaculatum (Cybium) immaculatus (Salmo) Imostoma	863 689 107 472 114 9, 867 620 620 106, 881 466 113, 882 193 914 427 320 498	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Chola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischanus	466, 466, 466, 922, 923, 536, 893, 971, 948, 966, 948, 464, 312, 172, 172, 934, 615, 256
hystrix.  I. Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyopus Ichthys Icichthys Icosteidæ Icosteidæ Icosteids Ictalurus Ictalurus Ictheloides Ictiobus illecebrosus immaculatu (Coryphæna) immaculatum (Cybium) immaculatum (Salmo) Imostoma imperator	863 689 107 472 114 9, 867 620 106, 881 486 113, 882 193 914 427 320 498 909	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Ciola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischamus ischyrus (Lepomis)	466, 466, 466, 922, 923, 536, 899, 971, 948, 968, 948, 464, 464, 464, 464, 464, 464, 464, 4
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyobus Ichthyopyzon Icichthys Icosteidæ Icosteidæ Icosteidæ Icosteids Ictalurus Ictiobus Ictiobus Idlicchrosus Immaculata (Coryphæna) Immaculatum (Cybium) Immaculatus (Salmo) Imostoma Imperator Imperialis (Esox)	863 689 107 472 114 9, 867 620 106, 881 466 113, 882 193 914 427 320 498 909 372	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Toa Toglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischanus ischynus (Lepomis) (Purophrys)	466, 466, 923, 923, 923, 892, 490, 971, 948, 464, 464, 312, 172, 934, 615, 256, 474, 833
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyobus Ichthyopus Icichthys Icichthys Icosteidæ Icosteidæ Icosteidæ Icosteids Ictiobus Ictiobus Ictiobus Ictiobus Ictiobus Ictiobus Ictiobus Immaculata (Coryphæna) Immaculatu (Cybium) Immaculatus (Salmo) Imostoma Imperator Imperialis (Esox) (Mupus)	863 689 107 472 114 9, 867 621 619 620 106, 881 466 113, 882 193 914 427 320 498 909 372 914	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus  Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Chola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischanus ischyrus (Leponis) (Parophrys) (Pleuronectes)	466, 466, 922, 923, 893, 893, 893, 894, 971, 944, 966, 948, 464, 464, 312, 172, 172, 221, 934, 618, 256, 474, 833, 832, 832, 922, 922, 934, 934, 934, 934, 934, 934, 934, 934
hystrix.  I.  Icelns  Ichthælnrus  Ichthelis  Ichthyobus  Ichthyopus  Ichthyomyzon  Icichthys  Icosteidæ  Icosteidæ  Icosteidæ  Ictalurus  ictheloides  Ictiobus  illecebrosus  immaculata (Coryphæna)  immaculatum (Cybium)  immaculatum (Salmo)  Imostoma  imperator  imperialis (Esox)  (Mupus)  (Sebastes)	863 689 107 472 114 9, 867 620 106, 881 466 113, 882 193 914 427 320 498 909 372 914 679	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischams ischyrus (Leponis) (Pleuronectes) Isesthes	466, 466, 923 923 923 892 490, 971 948 464 464 312 172 172 221 934 474 833 959, 960
hystrix.  I. Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyobus Ichthyomyzon Icichthys Icosteidæ Icosteidæ Icosteids Ictalurus Ictalurus Icthobus Illecebrosus Illecebrosus Immaculatu (Coryphæna) Immaculatum (Cybium) Immaculatus (Salmo) Imostoma Imperialis (Esox) (Mupus) (Sebastes) (Tylosurus).	863 689 107 472 114 9, 867 621 619 620 106, 881 488 193 914 427 320 498 909 372 914 679 9372	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Ciola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischanus ischyrus (Lepomis) (Purophrys) (Pleuronectes) Isesthes	466, 466, 923, 923, 892, 490, 971, 948, 464, 464, 317, 172, 172, 172, 173, 833, 832, 959, 966, 779
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyobus Ichthyomyzon Icichthys Icosteidæ Icosteidæ Icosteidæ Icosteins Ictalurus ictheloides Ictiobus illeccbrosus immaculatu (Coryphæna) immaculatum (Cybium) immaculatum (Cybium) immaculatus (Salmo) Imostoma imperator imperialis (Esox) (Mupus) (Sebastes) (Tylosurus) impetiginosus	863 689 107 472 114 9, 867 620 106, 881 486 113, 882 193 914 427 320 408 909 372 914 679 372 540, 973	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Ciola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischamus ischyrus (Lepomis) (Parophrys) (Pleuronectes) Isesthes Isesthes Isestanicus isodon	466, 466, 466, 923, 923, 892, 490, 977, 946, 464, 466, 312, 172, 221, 934, 615, 256, 474, 833, 832, 959, 960, 960, 24, 874, 874, 874, 874, 874, 874, 874, 87
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyobus Ichthyopus Ichthys Icosteidæ Icosteidæ Icosteidæ Icosteins Ictalurus Ictheloides Ictiobus Iillecchrosus Immaculata (Coryphæna) Immaculatum (Cybium) Immaculatum (Cybium) Immaculatum (Salmo) Imostoma Imperator Imperialis (Esox) (Mupus) (Sebastes) (Tylosurus) Impetiginosus Inæquilobus	863 689 107 472 114 9, 867 620 106, 881 466 113, 882 193 914 427 320 498 909 372 914 679 372 540, 973 223	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischams ischyrus (Lepomis) (Parophrys) (Pleuronectes) Isesthes Isesthes Isodon Isogomphodon	466, 466, 466, 923, 923, 892, 490, 971, 948, 464, 464, 312, 172, 934, 615, 256, 474, 833, 832, 959, 960, 748, 874, 23
hystrix.  I.  Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyomyzon Icichthys Icosteidæ Icosteidæ Icosteids Ictalurus ictheloides Ictiobus illecebrosus immaculata (Coryphæna) immaculatus (Salmo) Imostoma imperator imperialis (Esox) (Kupus) (Sebastes) (Tylosurus) impetiginosus inequilobus ineisor	863 689 107 472 114 9, 867 620 106, 881 466 113, 882 193 914 427 320 498 909 909 914 679 372 540, 973 223 480	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Cliola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischanus ischyrus (Lepomis) (Purophrys) (Pleuronectes) Isesthes Isogomphodon isolepis (Aphredoderus)	466, 466, 466, 923, 923, 892, 490, 977, 946, 464, 466, 312, 172, 221, 934, 615, 256, 474, 833, 832, 959, 960, 960, 24, 874, 874, 874, 874, 874, 874, 874, 87
hystrix.  I.  Icelns Ichthælnrus Ichthælnrus Ichthyobus Ichthyobus Ichthyopus Icosteidæ Icosteidæ Icosteidæ Icosteidæ Ictalurus ictheloides Ictiolus illecebrosus immaculata (Coryphæna) immaculatum (Cybium) immaculatum (Cybium) immaculatum (Gybium)	863 689 107 472 114 9, 867 620 106, 881 466 113, 882 193 914 427 320 498 909 372 914 679 372 540, 973 223 480 304	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Chola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischanus ischyrus (Lepomis) (Parophrys) (Pleuronectes) Isesthes	466, 466, 466, 923, 923, 892, 490, 971, 944, 464, 464, 464, 464, 464, 464, 464
hystrix.  I. Icelns Ichthælnrus Ichthelis Ichthyobus Ichthyobus Ichthyos Icichthys Icosteidæ Icosteidæ Icosteidæ Icosteids Ictalurus Ictheloides Ictiobus Iillecebrosus IIImmaculatu (Coryphæna) Immaculatus (Salmo) Imostoma Imperiatis (Esox)  (Mupus) (Sebastes) (Tylosurus) Impetiginosus Inequilobus Incisor Innonnu. Inconnu.	863 689 107 472 114 9, 867 621 619 620 106, 881 487 193 914 427 320 498 909 372 914 679 372 540, 973 223 480 394	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Ctiola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischamus ischyrus (Lepomis) (Purophrys) (Pleuronectes) Isesthes Isodon Isogomphodon isolepis (Aphredoderus) (Lepidopsetta) (Parophrys)	466, 465, 466 923 923 923 892 490, 971 946 464 464 317 172 172 221 934 454 833 959, 960 24, 874 23 461 832
hystrix.  I.  Icelns Ichthælnrus Ichthælnrus Ichthyobus Ichthyobus Ichthyopus Icosteidæ Icosteidæ Icosteidæ Icosteidæ Ictalurus ictheloides Ictiolus illecebrosus immaculata (Coryphæna) immaculatum (Cybium) immaculatum (Cybium) immaculatum (Gybium)	863 689 107 472 114 9, 867 620 106, 881 466 113, 882 193 914 427 320 498 909 372 914 679 372 540, 973 223 480 304	(Archoplites) (Centrarchus) (Genytremus) (Pomadasys) (Roccus) inurus Ioa Ioglossus ionthas ios irideus (Centrarchus) (Labrus) (Salmo) iris (Chola) (Hypsilepis) (Leuciscus) Irish Pompano Isabelita ischanus ischyrus (Lepomis) (Parophrys) (Pleuronectes) Isesthes	466, 465, 466 923 923 923 892 490, 977 946 966 464 464 312 172 172 221 934 615 256 474 833 959, 9660 279 24, 874 23 461 832 832

	Page.		Page.
Isopsetta	832	L.	
Isospondyli	256		
1stiophorus	421	labiatus	127
lsuropsis	28	Labidesthes	
Isnrus		Labracina	527
ishings	, 20, 011	labradoricus (Acanthocottus)	704
J.		(Coregonus)	299
<b>J</b> .		(Cottus)	704
Jack	656	Labrax	528, 641
Jack Salmon	525	Labridæ	597
jacksoni	595	Labrinæ	598
jacobi	571	Labrosomus	
	417	labrosus (Ceratichthys)	217
jacobœa			
jaculus	202	(Zoarces)	784
jaok	705	lacers	
japonensis	309	lacertosus	192
japonicus	723	Lachnolæmus	600
jarrovii (Lepidomeda)	252	lacrymalis	140
(Minomus)	123	laciniata	908, 969
jejunus	194	Lactophrys	853
jemezanus	203	lacustris	108, 882
jeniguano	925	Lady-fish	,
Jerker	212	Læmargus	14
jessiæ	518	lætabilis	175
Jew-tish		laetus	
		lavicaudatus	386
John A. Grindle	94		
Johnius	569	lævigatus (Agonus)	723
Johnny	718	(Antennarius)	846
Johnny Darter	492	(Chironectes)	846
Johnny Verde	536	(Lagocephalus)	860
John Paw	540	(Tetrodon)	860
jonesi	347	kevis (Acipenser)	87
Jordanella	327	(Mustelus)	60, 870
jordani (Hemilepidotus)	715	(Plenracromylon)	60
(Hippoglossoides)	827	(Raia)	42
josephi		(Rhinotriacis)	
jugalis	172	La Fayette	
Jugulares	783	Lagocephalus	
-		lagocephalus (Chirus)	
Julidina	598	(Grammatopleurus)	
Jumping Mullet,	142	(Labrax)	
Jump-rocks	142		306
June Sucker	132	(Oneorbynchus)	
Jurel	912	(Salmo)	
		Lagochila	143
K.		Lagodon	
land.	0.14	Lake Herring	
kaupi	364	Lake Sturgeon	
kayko	306	Lake Trout	314
Kelp-fish		lalandi 444	,912,913
kentuckiensis	179, 180	lamia 2	3,60,873
kennerlyi	309	lamiella	873
kennicotti (Catonotns)	514	Lamna	. 29
(Coregonus)	298	Lamnidae	28
keta	305, 307	lamotteni	868
Killifishes331,	332, 336	Lamper-eel	11
King-fish		Lampern	
King-of-the-Herring		Lampetra	
King-of-the-Mullets	563	lampetra formis	
King-of-the-Salmon	618	Lamprey	
King Salmon			
	306	Lampridida	
kisntch		Lampris	
Krasnaya Ryba	308	Lampugus	
kumlieni	,	Lancelet	
Kyphosus	972	lanceolata (Sciana)	. 570, 93 <b>1</b>
brantank	200	langualature (Propoliticatoria)	57 607

	Page.		Page.
lanceolatus (Eques)	932	Lepidorhombus	813
(Gobius)	636	Lepidosteidæ	8
(Homoprion)	570	Lepidosteus	90, 886
(Limax)	3,867	lepidum (Boleosoma)	51
(Stelliferus)	570	lepidus (Gobius)	63
Lancet-fish	274,276	(Oligocephalus)	51
Lant	414	(Pœcilichthys)	51
Large-mouthed Black Bass	484	Lepiopomus	47
Large-scaled Sucker	140	Lepisoma	76
Larimus	578, 933	Lepomis	472, 48
lata	67	leptacanthus (Noturus)	9
laterale (Ditrema)	594	Leptagonus	726, 95
lateralis (Abramis)	251	Leptoblennius	77
(Alvarius)	522	Leptocardii	
(Artedius)	690	Leptocephalidæ	36
(Calycilepidotus)	690	Leptocephalus	362, 96
(Embiotoca)	595	leptocephalus	21
(Icclus)	689	Leptoclinus	77
(Mylocheilus)	225	Leptocottus	71
(Pæcilichthys)	522	Leptogunnellus	77
(Richardsonius)	251	Leptophidium	79
(Scorpænichthys)	690	Leptops	88
(Tæniotoca)	595	Leptorhyuchus	36
(Zygonectes)	341	leptorhynchum	
laticaudus (Scoliodon).	24	Leptoscopidæ	75:
laticeps (Actobatis)	879	leptosomus	249
(Cephaloscyllium)	59	Lepturus.	423
(Scyllium)	58, 59	lepturus (Anarrhichas)	78:
(Stoasodon)	879	(Trichiurns)	42
latifasciatus	329	lessonii (Tetrapturus)	90
latifrons	782	lesueurianum (Exoglossum)	16
Latilida		Letharchus	89
latimanus		leuchtenbergi	36
latior	299	lenciodus	
latipinna (Mollienesia)	347	Leuciscinæ	146
latipinnis (Catostomus)	125	leuciscus	230
(Zaniolepis)	647	leucops (Photogenis)	201
latirostris	879	lencopus (Photogenis)	180
laurettæ	889	leucorhynchus	38, 876
lanta	453	Leucos	
Laviuia	152	Lencosomus.	
Lawyer	94, 802	leucostictus	610
Least Darter		Leucus	
Leather-jacket	523	Leuresthes	408
Leather-sided Minnow		Leurynnis.	784
Lebias	234	· · · · · · · · · · · · · · · · · · ·	315
Leisomus	860	libertatis	269
Leiocottus .	711	Limanda	
Leiostomus	574		820
leiurus	395	limandoides	
Le-Kai	305		
Lembus	630	limi Limia	350
Lemniscati	362		342
lemniscatus		Limnurgus	54-
lentiginosus	100 65	limosa (Myxine)	101
leonensis		limosus (Pilodictis)	102
	517	(l'imelodus)	
leoninaLepibema	174	lineata (Alosa)	267
•	529	(Coryphæna)	973
lepida (Boleose &a)	517	(Echeneis)	
(Cliola)	177	(Emblotoca)	595
Lepidion	800	(Liparis)	
Lepidogobius		(Novacula)	605
Lepidoleprus.	811	(Sciæna)	,
Lepidomeda	251	(Tigoma)	237
Lepidopsetts	531, 833	(Trigla)	736

	Page.		Page.
lineatus (Achirus)	841	Long-eared Sun-fish	477
(Amblodon)	568	longiceps (Hybopsis)	168
(Cyclopterus)	742	(Silioma)	241, 887
(Dormitator)	632,944	longicollis	900
(Genyonemus)	574	longimanus	482
(Grystes)	646	longipinne (Holocentrum)	459
(Labrax)	529	longipinnis (Rhombus)	451
(Liostomus)	575	longirostris (Alburnops)	167
(Micropogon)	575	(Catostomus)	126
		(Cliola)	167
(Mugil)			37-t
(Phthirichthys)	969	(Esex)	377
(Pleuronectes)	842	(Euleptorhamphus)	377
(Prionotus)	736	(Hemirhamphus)	
(Roccus)	529	(Tylosurus)	
(Squalius)	236	longirostram (Catostomus)	124
(Trichodon)	627	longispinis	480
(Xyrichthys)		Long-nosed Dace	207
(Zygonectes)	339	Gar	91
lincolata (Cliola)	168	Sucker	127
(Mollienesia)	894	longulus	473
(Pelamys)	428	longus	899
(P@cilia)	347	Look-down	439
lineolatum (Etheostoma)	513	Lophiid:e	844
lineolatus (Alburnus)	168	Lophius	844
(Catonotus)	513	lophius	107
(Leuciscus)	168	Lophobranchii	381
(Zygonectes)	341	Lopholatilus	624
Ling646	802, 909	Lophopsetta	815
linsleyi	514	lordii	320
Liocottus	711, 955	loricatus	723
liolepis		Lota	801
Liomonaeanthus		lota (Gadus)	
Liouiscus		lonisianæ	
liopeltis		lubricum	
Liopsetta		Lncania	
liorus		lucens	
liosternus		fuciae	
Liostomus		lucidus (Coregonus)	
Liparidida		(Luxilus)	
and the second s		(Notemigonus)	
liparina		(Salmo)	
Liparis		lucioceps	
liparis			
Lipomyzon		Lucioperca	
Lirns		Luciotrutta	
lirus (Lepomis)		lucius (Esox)	
(Minnilus)		(Ptychochilus)	
(Nototropis)		Indibunda	
Litholepis		lugubris	
littoralis (Eugomphodus)		lumbricus	
(Menticirrus)		Lumpenus	
(Odontaspis)	. 874	lumpenus	
(Squalus)		Lump-sucker	
(Umbrina)	. 577	Lumpus	
liturosus	. 966	lumpus	
lividus (Petromyzon)		luna (Lampris)	453
(Silurus)	. 105	(Pomotis)	
Liza	. 403	(Zeus)	
Lizard-fish	. 279, 280	lunatus	
Lobotes	. 55 t	lunulatus	
Lobotinæ	. 546	lupus (Amiurus)	
lockingtoni		(Anarrhichas)	
Log Perch		(Ictalurus)	
lonchurus		(Pimelodus)	
longa (Dasibatis)		Inteus	
Longo	317	Intipinnis	

	Page.		Page
Lutjaninæ	546	maculatus (Alvordius)	
Lutjanus547,		(Apogon)	93
Intrensis	,	(Bodianus)	53
luxatus	132	(Bothus)	81
luxiloides	177	(Clinus)	77
lycaodon		(Cryptacanthodes)(Diodon)	78 86
Lycodidæ	783	(Dormitator)	
Lycodalepis	788	(Hadropterus)	50
Lycodes	785	(Heptranchias)	6
Lycodopsis	784	(Holocentrus)	54
lyricus	633,945	(Hypeneus)	56
Iynx	107	(Labrus)	58
lythrochloris	478	(Lumpenus)	77
Lythrurus	185, 196	(Monoprion)	93
		(Mullhypeneus)	56
М.		(Mullus)	56
macarellus	433	(Nothonotus)(Notorhynchus)	50
Macho	403	(Platypecilus)	34, 6 34
mackenzii	304	(Pleuronectes)	81
Mackerel Scad	432	(Rhypticus)	54
Mackinaw Trout	317	(Scomber)	42
maclura	46, 47	(Scomberomorus)	42
macrocephalum (Etheostoma)	501	(Serranus)	54
macrocephalus (Alvordius)	501	(Stichæus)	77
(Gadus)	804	(Upeneus)	56
(Gunnellus)(Semotilus)	767	maculocinetus	61
macrochilus	221 128	maculofasciatus	53 80
macrochirus	475	maculoseriatus	64
Macrodonophis		maculostriatus	86
macrolepidota (Myxostoma)	140	maculosus (Acipenser)	8'
macrolepidotum (Moxostoma)	140	(Centrarchus)	46
macrolepidotus (Catostomus)	140	(Centridermichthys)	71
(Leuciscus)	223	(Gadus)	803
(Pogonichthys)	223	(Oligocottus)	71 82
macrops	927	(Paralichthys)(Pimephales)	15
macropterum (Exoglossum)	130	Mademoiselle	57
macropterus (Centrarchus)	463	mæandricus	74
(Labrus)	464	magdalenæ	586
macrorhynchus	377	mainensis	39
macrostoma	177	majalis	33
Macrourus	811	major (Actinochir)	74
Macrozoarees	27 784	(Cyclopterns)	74 74
Macruridæ	810	(Liparis)(Ptychocheilus)	22
Macrurus	811	Malacanthidæ	
macrurus (Ophichthys)	898	Malacostens	28
(Oxyodontichthys)	898	Malasheganay	56
macularius	330	maliger	673, 67
maculata (Amia)	930	malleus	20
(Eleotris)	632	Mallotus	
(Etheostoma)(Hemitremia)	508	Malma!	319
(Lophopsetta)	$\frac{162}{816}$	malma (Salmo)	319, 320 850
(Morone)	483	Malthe	850
(Perca)		Malthida	84
(Sciæna)	632	Mancalias	848
maculaticeps	492	Man-eater Shark	30
maculatum (Aulostoma)	390	Mangrove Snapper	549
(Boleosoma)	492	manitou	500
(Cybium)	426	Manjuari	93
(Cynoscion)	581, 934	Manta	5

	Page.		Page.
mau*a	52	megacephalus (Chitonotus)	699
mapo (Gobius)	945	(leclus)	662
margaritatus	958	Megalocottus	707
margaritus	235	Megalopina	261
margarotis	471	Megalops	261
marginata (Uranidea)	698	megalops (Alburnellus)	195
marginatum (Ophidium)	792	(Alburnus)	195
marginatus (Brosmius)	796	(Ditrema)	590
(Brosmophycis)	796	(Ennichthys)	591
(Dinematichthys)	796	(Minnilus)	195
(Halias)	796	(Pimelodus)	109
(Hemirhamphus)	902	(Trycherodon)	247
(Lepoinis)	478	megalotis	, 478, 480
(Noturus)	100	melampterus	309
(Pomotis)	478	mclanocephalus	158
marina (Perea)	652	melanogaster	823
marinus (Elurichthys)	111	Melanogrammus	803
(Esox)	902	mclanops (Bryttus)	468
(Petromyzon)10, 11, 867,		(Calliurus)	
(Sebastes)	0.51	(Catostomus)	
(Silurus)	111	(Dionda)	157
(Tylosurus)	902	(Glossoplites)	468
marmorata (Pteroplatea)	47	(Haplochilus)	
marmoratus (Amiurus)	104	(Hybograthus)	157
(Antennarius)	846	(Icthelis)	473
(Cottus)	700	(Lepomis)	473
(Cremnobates)	902	(Minytrema)	136
(Hemitripterus)	717	(Sebastes)	,
(Pimelodus)	104	(Sebastodes)	6.8
(Rhinichthys)		(Zygonectes)	
(Scorpænichthys)	716	melanopterum	552
•	3, 57 353	melanostietus	828
Muskallunge	353	melanotis (Limamuræna)	356
masoni	313	(Muraena)	
massachusettensis	857	melanotus (Catostomus)	159
Mastacembelidæ	368	melanura (Perca)	
matamorensis	347	melanurus (Exocœtus)	
Mathemeg	882	(Ocynrus)	548
mattowacca	267	melas	101
matutinus	199	meleagris	
mauritii	449	Meletta	
Maurolicus	283	Melletes	716
maxillaris	768	Menidia	
maxillingua	160	menidia (Atherina)	
maxillosus (Gnathypops)	942	(Atherinichthys)	407
(Opisthognathus)	943	Menhaden	269
(Rhinichthys)207,	208, 885	menhaden	270
maximus31,	61, 875	Menonionee White-tish	298
May fish	332	menona	335
May Sucker	144	Menticirrus	576
Meda	252	meridionalis (Amiurus)	106
Medialuna	562	(Bubalichthys)	116
mediocris	266	(Cottus)	697
medirostris	86	(Ictalurus)	106
mediterranea (Sarda)	427	(Selerognathus)	116
mediterraneus (Hoplostethus)	458	(Uranidea)	697
(Scomber)	428	merki	300
medius (Anisarchus)	777	Merlangus	807
(Calamus)	928	merlangus (Anoplopoma)	650
(Clinus)	777	Merluccio	809
(Grammatens)	928	merluceius (Gadus)	809
(Lumpenus)	777	Merlucius	808
(Sticharus)	777	Merou.	
meracemanns (Calamns)	926	mercensi	700

	Page.		Page.
mesœus	492	Minomus	124
mesogaster	377	minor	781
Mesogonistius	471	minuta	698
Mesopriou	547	Minytrema	135
mesotrema	461	mirabile (Exoglossum)	205
metallica	209	mirabilis (Clupea)	265
Metoponops	816	(Gillichthys)	636
Metrogaster	588	(Phenacobius)	205
mexicanum (Dorosoma)	887	Mississippi Cat	108
mexicanus (Chatoëssus)	888	Missouri Sucker	121
(Mugil)	403, 908	missuriensis	
Michigan Herring	301	mitchilli (Cottus)	702,955
Grayling	303	(Engranlis)	273, 888
Micristius	338, 340	(Stolephorus)	888
Micristodus	32,875	miurus	99
microcephalus (Gasterosteus)	395	modesta (Cheonda)	242
(Somniosus)	14, 15, 57	modestus (Julis)	604
Microgadus	805	(Oxyjulis)	604
microlepidotus	151, 152	(Pseudojulis)	604
microlepis	538	(Squalius)	242
microlophus	482	Mojarra	611, 934
Micrometrus	588, 936	Mola	865
Microperca	522	mola	866
Micropogon	575	Molacanthus	865
micropogon	212	molestum	638
microps (Calliurus)	473	Mollienesia	346, 894
(Caulolatilus)	626	mollis	842
(Corvina)	570	Molya	801
(Cottunculus)	688, 952	molva (Gadus)	801
(Lepomis)	473	Molvella	790
(Sparus)	928	Monacanthus	856, 965
Micropterus	484	monachus	217
Micropteryx	440	Mongrel White-fish	301
micropteryx	203	Moniana	165, 173
micropus (Clupea)	263	Monk-fish	35, 844
(Gasterosteus)	394	Monolene	840
microstigmius	900	Monoprion	931
Microstoma		monopterygius (Aspidophoroides)	724
microstoma (Cliola)	168	(Chirus)	64:
(Gasteropelecus)	289	(Cottus)	72.
(Uranidea)	698	(Hexagrammus)	642
Microstomus	838	(Labrax)	642
microstomus (Citharichthys)	817	Monosira	933
(Minnilus)	168	montagui	743
Midshipman	751	montana (Gila)	234
milberti (Arius)	110	Montana Grayliug	303
(Carcharias)	23, 872	montanus (Clinostomus)	234
(Carcharinus)	22	(Squalius)	234
(Eulamia)		(Thymallus)	303
milesi	159	Moon-eye	
Miller's Thumb		Moon-fish	43!
milneri (Calamus)	928	Moray	355
(Nocomis)		mordax (Atherina)	293
(Pagellus)	556	(Crotalopsis)	359
(Sparus)		(Engraulis)	272
milnerianus	243	(Macrodonophis)	
mineopas	473	(Muræna)	356
miniatum (Peristedium)	732	(Ophichthys)	897
miniatum (Lepomis)	476	(Osmerus)	293
(Sebastichthys)	664	moringa	805
(Sebastodes)	663	morio	
minima (Abeona)		Morone.	530
Minnilus		Morrhua	804
Minnow	242	morrhua (Gadus)	804
MIDHOU	-7-	(caucas)	

	Page.		Page
morrisi	362	Mystriophis	35
Mossbunker	269	Myxine	
Motella	796	Myxinida	
moncharta	610	Myzonts	
Monse-tish	845	Myzopsetta	80
Moxostoma	132, 136		
mucosa (Liparis)	744	N.	
mucosum (Xiphidion)	773	nacrea	23
mucosus (Acanthocottus)	703, 955	namayeush	317, 89
(Lycodalepis)	788	Nanostoma	50
(Lycodes)	788	nanus	272, 88
(Neoliparis)	744	Narcine	87
(Xiphister)	772	naresi	319, 96
mucronata (Perea)	531	narinari	50, 87
mucronatum (Ophidium)	767	Nassau Grouper	91
mucronatus (Neoconger)	360, 900	nasus	37
Mud-cat	101, 102	nasuta (Malthe):	85
Mud-dab	837	nasutum (Campostoma)	14
Mud-fish	91, 636	nasutus (Argyrens)	20
mudfish (Fundulus)	331	(Lenciscus)	20
Mud-fishes	92, 350	(Rhinichthys)	207, 88
Mud Minnows	349, 350	natalis	10
Mud Sun-fish	469	NaucIerus	44
Mutlle:jaw	696	naucrateoides	41
Mugil	402	Naucrates	44
Mugilidæ	401	naucrates (Echeneis)	41
mugiloides	632	(Leptecheneis)	41
muikisi	313	Nautichthys	72
Mullet	239	nebrascensis	21
Mullets		nebulifer (Catostonus)	88
Mullidæ	564	(Labrax)	53
Mullhypeneus	565	(Paralabrax)	53
Mullus		(Serranus)	53
multifasciata		nebuliferus (Catostomus)	55
multifilis	758	nebulosa (Etheostoma)	50
multilineata (Pœcilia)	347	(Sciæna)	57
multilineatus (Labrax)	530	(Umbrina)	57
multimaculatus (Diodon)	863 336	nebulosus (Acantholebius)	64
Mummichog	914	(Centronotus) (Chiropsis)	76
Muræna		(Chirus)	64 64
Muranida	355	(Clinus)	77
engyschistæ	355	(Gasterostens)	39
Muraenoides	766	(Lycodes)	78
Muranopsis		(Menticirrus)	
murinus		(Pimelodus)	10
musica	246	(Sebastes)	67
Musquaw River White-fish	299	(Sebastodes)	67
Mustelus	9, 59, 870	(Zeus)	45
mutatum	492	Needle-fish	37
Myctophum	281	neglectus	56
mykiss	313	Negrita	53
Myliobatidae	49	Nematognathi	9
Myliobatis 50,	879, 880	Nemichthyidæ	36
Mylocheilus	224	Nemichthys	36
Mylochilus	221	Neoclinus	76
Myloleucus 244,	245, 887	Neoconger	36
Mylopharodon	225	neogæus	24
myops	281	neohantoniensis	29
Myoxocephalus	706	Neoliparis	74
Myrichthys	360	Neomænis	54
Myriolepis	619	nephelus (Lepomis)	47.
Myrophis	899	(Tetrodon)	96
mystacalis	475	nerka	30
mystinus	659	Nerophis	38

	Page.		Page.
nevisensis	502	nitida (Pomotis)	478
newberrii (Eucyclogobius)	638	nitidus (Alburnus)	202
(Fario)	313	(Centrarchus)	465
(Gobius)	638 637	(Salvelinus)	321 180
(Lepidogobius)  New Light	464	niveatus	541
newmani	497	niveiventris	108
nicholsi	946	nobile (Atractoscion)	579
nigellus	159	(Cynoscion)	933
niger (Ammocœtes)	9, 867	nobilior (Esox)	353
(Astronesthes)	288	nobilis (Conodon)	923
(Bubaliehthys)	116	(Johnius)	579
(Chiasmodon)	810	(Gambusia)	346
(Conger)	707	(Heterandria)	$\frac{346}{551}$
(Cottus) (Esox)	352	(Perc ) (Pomadasys)	551 550
(Gasterosteus)	396	Nocomis	211
(Gobius)	633	Nomeidæ.	448
(Malacosteus)	287	Nomeus	449
(Squalius)	239	norvegica (Perca)	651,652
Nigger-fish	541	norvegicus (Coryphænoides)	812
nigra (Astronesthes)	287	(Macrurus)	813
(Elacate)	419	norwegicus (Sebastes)	652
(Etheostoma)	492	notabilis	211
(Gila)	239	Notacanthidæ	370
(Sciæna)	572 599	Notacanthus	-
(Tautoga)	917	notata (Atherina)	110 408
(Cycleptus)	120	(Atherinichthys)	407
(Serranus)	916	(Belone)	373
(Squalins)	242	(Cliola)	
(Tigoma)	242	(Cyprinella)	178
nigricans (Acanthurus)	617, 941	(Dorosoma)	271
(Amiurus)	108	(Labrax)	530
(Camarina)	560	(Malthe)	850
(Catostomus)		(Menidia)	
(Centropristis)533		notatum (Chirostoma)	
(Chætodon)		notatus (Hyborhynchus)	
(Girella)		(Lepomis)	
(Huro)		(Minnilus)	
(Hylomyzon) (Hypoplectrus)		(Pimelodus)	
(Ictalurus)		(Porichthys)	
(Micropterus)		(Semotilus)	
(Petromyzon) 11		(Tylosurus)	
(Pimelodus)		(Zygonectes)	339
(Plectropoma)	537	Notemigonus	
nigrilabris		Nothonotus	
nigripinnis (Argyrosomus)		nothum580	
(Coregonns)		Notidanidæ	
(Rhypticus)		Notidanus	
nigritus540		Notorhynchus	
nigrocinctus		notospilotus	
nigrofasciatus (Fundulus)		Notropis	
(Hadropterus)		nottii	
nigromaculatus		Noturus	
nigromarginata		Novacula	
nigrotæniata	. 164	novæ-angliæ	
nigrotæniatus (Graodus)		noveboracensis (Exocætus)	
(Hybognathus)		(Gasterosteus)	
nigrum (Bolcosoma)		(Naucrates)	
(Petromyzon)		novemlineatus	
Nine-spined Stickleback		nubila (Apocope)	
niciaa (moniana)	. 113	Transm (Trivoolie)	. 210

	Page.		Page.
nubila (Cliola)	167	Oceanic Bouito	430
nubilus (Alburnops)	167	oceanica (Anguilla)	363
•			
(Argyreus)	210	oceanicus (Conger)	363
(Centroblennius)	778	(Gobionellus)	606,947
(Leptoblennius)	778	(Gobius)	636
(Lumpenus)	778	ocella	885
	778		823
(Sticheus)		ocellaris (Chacnopsetta)	
nuchalis 155, 156,	157,968	(Fundulus)	891
nuchipinnis	762	(Paralichthys)	972
nnecensis	485	(Platessa)	822, 972
Numb-fishes	38, 39	(Pseudorhombus)	
nummifer	,	ocellata (Corvina)	571, 572
nunmularis	865	(Gymnothorax)	357
Nurse	15	(Mura·na)	356
Nurse-Sharks	17, 18	(Perca)	572
nuttalli (Exocœtus)		(Raia)	40
Nyctophus	282	(Sciæna)	571, 931
		ocellatus (Acanthocottus)	955
Ο.	i	(Anarrhichthys)	782
1	0.45	·	
obesa (Algansea)	245	(Citharichthys)	964
(Tigoma)	237	(Hemirhombus)	964
obesus (Amiurus)	104	(Herpetoichthys)	359
(Bryttus)	470	(Hippoglossus)	
(Enneacanthus)	470	(Muraenoides)	766
(Leuciscus)	245	(Murænopsis)	359
(Leucus)	245	(Ophichthys)	359
(Pomotis	470		
		(Zeus)	
(Squalius)	237	ocellatum (Ophidium)	766
obliquus	574	ocellicauda	94
oblonga (Chænopsetta)	823	octodecimspinosus	701
(Platessa)	823	•	
		octofilis	
oblongum (Moxostoma)	134	Octogrammus	641
oblongus (Cyprinus)	132, 134	octogrammus	641
(Paralichthys)	824	octonemus	413
(Plenronectes)			
		oculetus	
(Pseudorhombus)	823	oculofasciatus	721
obolarius	396	Ocyurus	548
obscura (Eulamia)	60	Odontaspididæ	874
obscurus (Carcharias)22	872 967		
		Odontaspis	
(Carcharinus)	22	Odontopyxis	729
(Centrarchus)	485	ogac (Gadus)	. 804
(Lepiopomus)	480	Ohio Shad	
(Leponis)	480		
		Ohio Sturgeon	
(Pomotis)		Old-wife	. 574
(Squalns)	22	olidus (Hypomesus)	294, 295
obtusirostris	378	oligaspis	200
obtusa (Eulamia)	872	Oligocottus	
obtusus (Rhinichthys)			
		Oligocephalus	
(Squalus)		Oligoplites44	7, 913, 973
occidentalis (Abramis)	250	olisthostoma	934, 935
(Amia)	94	olivacea (Puccilia)	
(Catostomus)			
		olivaceus (Pimelodus)	
(Chorinemus)	447	olivaris	. 102,881
(Conger)	363	olmstedi	41.2
(Gasterostens)393		ommatus	. 824
(Girardinus)			
		omocyancus	
(Heterandria)		omostigma	. 963
(Leucosomus)	250	Oncocottus	. 704
(Luxilus)	250	Oncorhy nchus	
(Monacanthns)		Oneirodes	
(Notemigonus)			
		Onirodes	
(Noturus)		omtis	. 600, 936
(Oligoplites) 447	7, 914, 973	Onos	796
(Scombroides)		Opah	
(Torpedo)	. 29	Ophichthys	. ააა, 909

	Page		Page.
Ophidiidæ	79		604
Ophidium			648
Ophioblennius	75		532
Ophisurinæ	64 35	7.4	532
Ophisurus			518
ophryas			949 898
ophthalmicus	47.		916
Opistharthri	96	9.1	28
Opisthognathidæ	94		23
Opisthognathus	94		
Opisthomi	36		86
Opisthonema	26	s oxyums	91
Opladelus	10	Oyster-tish	600,750
Oplopoma	64		
Opsopæodus	24		
oquassa			702
Oquassa Trout	31.	r	440
orbis	74 42	( - 2	839
Orcynus		(org proceptatio)	839
oreas	15	(13,000)	785
oregoneusis	22	(-)	785 429
orientalis (Anarrhichas)	78	( )	
(Oncorhynchus)	30	(	292
(Pelamys)	42	(	429
(Salmo)	30		82
ornata (Aphoristia)	84		964
(Cliola)	17	Pagellus	556, 972
(Codoma)	17	Pagrus	556,972
(Embiotoca)	59	1 6 6 7	556,928
(Raia)	87		452
ornatum (Campostoma)	14		452
ornatus (Achirus)	84	1	480
(Cochlognathus)	16	1	865
(Esox)	35 76	( ) ( )	641
(Gunnellus)	76	, , , , , , , , , , , , , , , , , , , ,	836
Ornichthys	73		865 485
Orthagoriscidæ	86	F	482
Orthagoriscus	86		531
Orthodon	15		479
Orthopristis	55	,	221
Orthopsetta	81	i contract of the contract of	
oscula (Apocope)	21	(Pomotis)	482,483
(Corvina)	56	S (Semotilus)	221
osculații	53	palmipes	734, 735
osculus (Argyreus)	21		452
osmeriuus	15	1 2	442
Osmerus	29		564
ossens90			235
osteochir	41	pantnerma (Opiopoma)	646
ostcosticta	6		781
Ostraciidæ Ostracium	85 85	• •	646 121
Oswego Bass	48		157
Othonops	63:		716
Otolithinæ	56	1 2 2	890
Otolithus	58		890
otsego	29	1 1	
ouatalibi	54	paradoxus	687
ovalis			729
ovatus	442, 91		535
ovinus	32		276
ovis	55	Paralepis	277,278

	Page.		Page.
Paralichthys	821	Percarina	485
Paranthias	973		
Parascorpana		Perch	
parasitions	363	Perches	480
Paratractus		Percichthys	480
pardalis	858	Percida	480
Parephippus		Pereilia	488
Parepinephelus	613 537	Percina	499
Pareques	573	Percina	488
parietalis	158	percobromus	201
parkei	320	Pereomorphi	397
Parma	610	Percopsidæ	32:
parmatus	682	Percopsis	325
parmifera	878	perfasciatus	273, 274
Parophrys	831	periscopus	807
parovanus	246	Peristediinæ	730
parræ	553	Peristedion	73:
parrii	789	Peristedium	731
Parrot-fish	606	peristethus	731
paru (Pomaeanthus)	616	Permit	915
(Stromateus)	914	Peropus	719
parva (Lucania)		personatus	
parvipinne (Cynoscion)	580	perspicabilis	593 787
parvipinnis (Fundulus)	333	perspicillum	159
parvus (Centridermichthys) (Cottopsis)	695 695	Perspicuus	668
(Cyprinodon)	343	Pesca Vermiglia Pescadillo del Rey	409
(Sebastes)	671	Pescadito	235
pastinaca	47, 48	Pesce-rev	604
patatus	603	Petromyzon	
patris	708	Petromyzontidæ	6, 867
patronus	269	petrosus (Mugil)	* 404
patruelis345,	892, 893	(Serranus)	918
paueidens (Leurynnis)	785	(Trisotropis)	918
(Lycodopsis)	785	phalæna	578
(Oneorhynchus)	309	Phalangistes	728
(Salmo)	309	phaleratus	35
paueispinis 652,	656, 657	Phanerodon	
pavonaceus	939	Pharyngognathi	397
paxillus	785	phasganorus	900
Pêche Prêtre	659	phenax	47
peckianus (Syngnathus)	383	Phenacobius	205 97:
pectinatus (Pristis)pectinifer	72, 875	Philypnus	
pectoralis (Dallia)	762   351	phlehotomus	941, 571
Pediculati	843	phlegethontis	
Pegador	416	phlox	493
Pelamys	427	Phobetor	708
pelamys		Pholis	760
pellucida (Ammoerypta)	489	Photogenis	163, 179
pellucidum (Etheostoma)	490	photogenia	201
pellucidus (Pleurolepis)	490	Phoxinus	24:
(Thyris)	840	phoxocephalus	501
Pelodichthys	102	Phthirichthys	969
peltastes (Lepomis)	478	Phyeis	798
peltatus	503	Physiculus	800
peninsulæ		physignathus	219
pennatula	926	Physoclisti	367
pensacola (Harengula)	268	Physostomi	94
pentacanthus	459	Pickerel	
pepo (Scarus)	606	Picorellus	35:
Peprilusperarcuatus	450	pieturatus	911 847
Perea	832	pictus (Chaunax)(Chiropsis)	
• • • • • • • • • • • • • • • • • • • •	020, 910	(Cintopsis)	. 046

	Page.	į		Page.
pictus (Chirus)	645	1	platycephalus (Pimelodus)	10-
(Gyumelis)	789		Platyglossus	60:
(Julis)	938	ļ	Platygobio	219
(Oxylebius)	648	- [	platyodon	873, 967
(Platyglossus)	938	1	Platypodon	96
Picuda	412	ļ	Platypecilns	348
picuda (Sphyræna)	412		Platyrhina	87
pidiense	138		Platyrhinoidis	870
Pig-foot	681	Ì	platyrhynchus (Minomus)	122, 12-
Pike226,	351,352		platyrrhynchus (Pantosteus)	123
Perch	525		(Scaphirrhynchops)	8
pilatus	735		platystomus (Lepidosteus)	9
Pileoma	499	i	Platysomatichthys	81
Pilodictis	101,881		plebeins (Catostomus)	123
pilosus	862	1	(Gasterosteus)	39.
Pilot-fish	298	-	(Pantosteus)	12:
Pilot-fishes		1	plebejus (Mustelus)	87
Pimelepterinæ	546		Plectognathi	85:
Pimelepterus		ì	Plectospondyli	11
Pimelode livrée	100		plectrodon	95
Pimelometopon			Pleetropoma	
Pimephales	158		pleii	903
Pin-fish	558	ł	Plesioperca	500
pingeli	713	-	-	
pinguis	819		Pleuracromylon	59, 87
			pleuriticus	31-
pini	733		Pleurogrammus	
pinnatus	364		Pleurolepis	48
pinniger (Enneacanthus)	471		Plenronectes	83.
(Sebastodes)	662		Pleuronectidæ	813
(Sebastichthys)	663		pleurephthalmus (Antennarius)	84
(Sebastosomus)	663		Pleuronichthys	823
pinnulatus	446, 913		pleurostictus	713
Pipe-fish	382		plumbea (Chimæra)	5-
piptolepis	183		(Dienda)	15.
Pirate Perch	460		(Lampetra)	8, 5
piscatorius	844		plumbeolus	19:
Pisces	73	1	plumbeum (Zophendum)	15
pisculentus	336		plumbeus (Ammocates)	86
Pisodontophis	899, 969		(Carcharias)	873
pisonis	631		(Ceratichthys)	219
Pisoodonophis	899		(Gobio)	21
pisquetus	435, 912		(Petromyzon)	
pistilliger	708		(Squalus)	87
pituitosas	543		plumieri (Chætodon)	61:
pixanga	920		(Conodon)	55
placitus	157		(Diabasis)	97
Placopharynx	142		(Gerres)	
plagiusa	843		(Labrus)	97
Plagopterina	148		(Mugil)	40
Plagopterus	253	i	(Polydaetylus)	413
Plagyodus.			(Polynemus)	41:
Plaice	275			
	831		(Sciana)	55
plana	837		(Scomberomorus)	420
planeri	7		(Scorpena)	681
	185, 250		(Trichidion)	41:
Platessa	831		plumierianus	
platessoides	826		plutonia	878
Platichthys			pnenmatophorus	
Platirostra	83		Podothecus	729
platorhynchus (Acipenser)	88		Pœcilia	547
platostomus (Lepisosteus)	91		Pæcilichthys	51-
platycephalus (Amiurns)	103		Pæcilinæ	32
(Cottus)	706		Pœciliodes	34-
(Megalocottus)	707	1	pæcilioides	
(Noturns)	101		Peecilurichthys	253

	Page.		Page.
pæcibīrum	141	Pristida:	36
poeyi (Platyglossus)	938	Pristigaster	262
Pogonias	568	Pristipoma	550
Pogonichthys	223	Pristipomatida	545,880
Pogostoma	880	Pristipomatina	546
polaris (Blennius)	788	Pristis	37,875
(Boreogadus)	807	pristis	37
(Cottus)	706	Proarthri	967
(Lycodalepis)	788	probatocephalus	559
(Lycodes)	788	proche	169
(Merlangus)	807	productus (Merlucius)	809
Polistotrema		(Gadns)	809
politus (Seriphus)	582	(Merlangus)	809
(Tetrodon)		(Rhinobatus) 38	
Pollachius	806	prodiaris	522
Pollack	806	profundorum	
pollicaris	954	prolixam	150
polyacanthocephalus	703	promelas	158
		Promicrops.	
polyactocephalus	765 412	Promicropterus	543
Polynemidæ	- 1		
Polynemus		proriger (Clinostomus)	232
Polyodon	83	(Gila)	232
Polyodontidæ	82	(Lenciscus)	232
Polyprion	1	(Sebastichthys)	662
polytrema	657	(Sebastodes)	
Pomacanthus	615	proserpina	175
Pomacentridæ	609	Prosopium	297
Pomaeentrus	609, 939	prosthemius	219
Pomadasys	550, 923	protacanthus	465
Pomatomidæ	447	proteus	305
Pomatomus	448	Protoporus	203
Pomatopsetta	825	proximus	805,806
Pomolobus	265	pruinosa	806
Pomotis	472	Psettichthys	825, 828
pomotis	469	pseudoharengus	267
Pomoxys	464	pseudohispanica	887
Pompano	441	Pseudojnlis	604
Pompano (California)	451	Pseudopleuronectes	831, 837
ponderosus	108	Pseudopriacanthus	545
Pontinus	679, 951	Pseudorhombus	821
popei	478	Pseudoscarus	606
Porbeagle.	28	Pseudosciena	569
Porcupine-fish	862	Pseudosebastes	678
porcus		Pseudoxiphophorus	344
Porgee		Pseudupeneus	565
Porichthys		psittaculis (Julis)	937
Porocottus	707	psittacus	601
	1	Psychrolutes	686
Poronotus		•	683
porosissimus (Porichthys)		Psychrolatida	683
porosus (Cottus)		Psychrolutina	
(Esox)	352	Pteraclis	455
Potamocottus	695	Pterophryne	845
Potamotrygon	72	Pterophrynoides	
potsii	517	Pteroplatea	46
powelli		Ptilichthys	369
præcisus		Ptychocheilus	225
præstabilis	268	Ptychostomus	136
pretiosus	294, 295	Ptyonotus	709
Priacanthidæ	544	Puffer	
Priacanthus	544	pugettensis	692
princeps	625	pugetti	395
principis	603	pulchella (Liparis)	741
Prionodes	917	(Moniana)	175
Prionodon	99	(Tigoma)	238
Prionotus		pulchellus (Astatichthys)	518

	rage.		rage.
pulchellus (Chilonemus)	222	punctulatus (Pæcilichthys)	516
(Engraulis)	273	(Potamocottus)	696
(Haplochilus)	340	pungitius	393
(Leuciscus)	222	puniceus	155
(Leucosomus)	222	purpurascens (Lepomis)	480
(Oligocephalus)	517	purpuratus (Salmo)313,	314, 315
(Squalius)	238	purpurea (Tigoma)	238
(Zygonectes)	340	purpurescens (Anoplarchus)	771
pulcher (Labrus)	602	purpureus (Merlangus)	807
(Pimelometopon)	602	(Squalius)	238
(Semicossyphus)	602	putnami	498, 837
(Squalius)	236	pygmæa (Umbra)	350
(Trochocopus)	936	pygmæus (Gadus)	807
pulchra (Harpe)	602	(Gasterosteus)	394
(Tigoma)	236	(Leuciscus)	350
pullum (Chondrostoma)	149	Pygosteus.	393
pullus (Amiurus)	104	pyrrhomelas (Cliola)	184
(Monacanthus)	858	pytrasaution (outsia)	
(Pimelodus)	104	Q.	
pulvernlentus	245	quadracus	396
Pumpkin-seed	482	quadratus	613
pnnetata (Ganibusia)	344	quadricorne (Ostracium)	854
(Girella)	560	quadricornis (Agonus)	723
(Lamna)	29, 875	- (Aspidophorus)	723
· · · · · · · · · · · · · · · · · · ·		(Cottus)	704
(Perca)			722
(Sciæna)570, 931,		(Hypsagonus)	
(Trigla)	734	(Oncocottus)	705
punctatum (Myctophum)	281	(Ostracion)	854
punctatus (Aprionodon)	24, 874	quadrifasciatus	757
(Blennius)		quadrifilis (Cottus)	
(Bodianus)	919	quadrilateralis (Coregonus)	298
(Bryttus)	476	quadrilineatum (Hæmulon)	554
(Caranx)	432	quadriloba	51
(Carcharias)	24	quadrimaculatus	863
(Decapterus)		quadriseriatus	691
(Enneacentrus)	541	quadrituberculatus	
(Epinephelus)		quadrocellatus	
(Holocentrus)		Quaesilabia	143
(Ictalurus)		quatuordecemlaminatus	417
(Isesthes)	758	Queen-fish	582
(Lepomis)	476	quiescens	699
(Micristodus)	32,875	Quill-back	120
(Myrophis)	900	quinnat	307
(Osmerus)	294	quinquecinctus	616
(Phyeis)	798	_	
(Prionotus)	734,956	R.	
(Silurus)	109	Rabbit-fish	863
(Squalus)	24,874	Rabbit-mouth Sucker	144
(Stichæus)	775	radians (Scarus)	939
puncticulatus (Apogonichthys)	931	radiata (Raia)	41
punctifer (Crotalopsis)	359, 897	radiatus (Chœrojulis)	603
(Hybognathus)	884	(Platyglossus)	603, 973
(Ophichthys)	358	(Sparus)	
punctipinne (Siphostoma)	385, 905	rafinesquei	88
punctipinnis (Ayresia)	612	Raia39	877, 878
(Chromis)		Raiæ	36
(Dermatostethus)		Raiidæ	39, 876
punctulata (Corypha·na)		Rainbow Darter	514, 517
(Microperea)		Rainbow Trout	312
(Uranidea)		Raja	40
punetulatus (Calliurus)		raji	915
(Lampugus)		ranula	742
(Minnilus)		Ranzania	966
(Nothonotus)		rapax	226
(Pimelodus)		Rascacio	678, 680
(2 12220000) 11111111111111111		· · · · · · · · · · · · · · · · · · ·	

	Page.		rage.
rascacio	681	rhessodon	749
Rasciera	663	Rhina	35
Rasher	663	rhina (Raia)	43
rastrelliger	671, 672	Rhina	967
Rat-tish	54	Rhinichthys	
Rat-tail	811	rhinichthyoides	210
raveneli	352	Rhinobatidae	37, 876
Ray	36, 39	Rhinobatus	37, 63
Razor-fish	605	Rhinodontidæ	31, 875
Red Bass	571	Rhinonemus	
Red-eye		Rhinoptera	51
Red-eyed Bream	468	Rhinoscion	573
Red Fall-fish	189	Rhinotriaeis20, 59	
Red-fin	186	rhodochloris	
Red-fish		rhodorus	686
Red Grouper		rhodoterus	592
Red Gurnard	733	rhomaleus	
Red Horse136,		rhombeus	934
Red Minnow		Rhombochirus	417
Red-mouth	553	rhomboides	558
Red-mouth Buffalo-fish	114	Rhomboplites	549
Red Roncador	572	Rhombus	
Red Snapper		rhothea (Uranidea)	953
Red-spotted Trout		rhothens (Semotilus)	222 87
regale (Cybium)		rhynchaus	
(Cynoscion)		Rhynchichthys	459
regalis (Enchelyopus)		Rhypticina	528
(Johnius)		Rhypticus	54
(Otolithus)		ricei	
(Phycis)		richardi (Caranx)	951 376
(Scomber)		(Hemirhamphus)	
(Scomberomorus)		(Salmo)	290
regius (Blennius)		richardsoni (Coregonus)	
(Hybognathus)		(Corvina)	697
(Phycis)		(Cottns),	
Reina		(Eutychelithus)	
reinhardi (Careproctus)		(Rhamphocottus)	693
(Liparis)		(Trachidermus)	
reinhardti (Corynolophus)		Richardsonius	
(Himantolophus)		Ringed Perch	
(Motella)		ringens (Engraulis)	
		(Stolephorus)	
Reinhardtius		(Sudis)	
remora		Rio Grande Trout	
Remorapsis		rissoi (Trachurus)	
Reniceps		River Chub	
reticulata (Spatularia)		rivoliana (Seriola)	
reticulatus (Bryttus)		Roach	
(Chilomycterus)	1	Robalo	
(Esox)		robusta (Gila)	
(Gobiesox)		robustus (Clypeocottus)	
(Halieutichthys)		(1chthalurus)	
(Lepadogaster)		(Leuciscus)	
(Lycodes)		(Mylopharodon)	
(Pseudoxiphophorus)		Roccus	
(Trygon)		rochei	
retifer (Scylliorhinus)		Rock	
retifera (Murana)		Rock Bass	
retiferum (Scyllium)		Rock-cod	
retropinnis		Rock-fish	
Rhacochilus		Rockling	
Rhamphocottinge		Rock Salmon	
Rhamphocottus		Rock Trout	
Rheocrypta		Rocky Mountain White-fish	
Bull, Nat. Mus. No. 10			
Dilli, wat, with 10, 10, 10	,		

70 1	rage.		Page
Roncador573	2, 574, 928	rapertianus	8
roncador (Umbrina)		rupestris (Ambloplites)	46
Ronchil		(Bodianus)	466, 46
rondeleti (Carcharodon)	30, 61, 875	(Coryphæna)	81
(Exocœtus)	. 904	(Coryphænoides)	81
(Scomberesox)	. 375	(Labrus)	59
rosaceus (Cymatogaster)	. 590	(Macrurus)	81
(Micrometrus)		(Xiphister)	77
(Sebastes)		rntila	
(Sebastodes)		THEIR.	17
rosæ		s.	
roseus (Blennius)		sabina49	
(Centronotus)		Sabre-fish	91
(Gunnellops)		saburræ	95
(Luxilus)		Saccopharyngidæ	36
(Minnilus)		Saccopharynx	36
Rose-fish	. 651	Sacramento Perch	46
rossi (Lycodes)	. 787	Salmon	30
(Salvelinus)	321	Sturgeon	8
(Salmo)	. 321	Sadina	26
rostrata (Anguilla)		sagax (Clupea)	26
(Muræna)		sagitta	
(Platessa)		saida	,
			80
rostratus (Agonus)		Sail-fish	
(Alepocephalus)		Sailor's Choice	55
(Brachyopsis)		saira	37.
(Heterostichus)		Salar	309, 31
(Leptagonus)	. 955	salar	309
rothrocki	. 776	sallæi	16-
rotunda	. 865, 866	Salmo	309
rotundatum	. 289	Salmon	312, 52
Round-fish	. 298	salmonea (Perca).	520
Round Herring		salmoneum (Stizostedium)	52
Round Robin	1	salmoides	
Roussette		salmoneus (Esox)	
ruhellus		(Scombrocotfus)	65
ruber	1		
		Salmonidæ	28
ruberrimus		Salmon-killer	39
rubicunda (Parma)		salmonoides	48
rubicandus (Acipenser)		Salmon-Trout.	31:
(Glyphisodon)	610	Salmon-Trout of the Columbia	314
(Hypsypops)	. 610	saltator	448, 91
(Pomacentrus)	. 610	saltatrix	448, 91
rubricanda	. 477	saludana	170
rubricrocens	189, 190	Salvelinus	316, 318
rubrifrons (Alburnellus)		sapetæ-crucis	938
(Alburnus)		Sand Eel	414
(Ceratichthys)		Sand-dab.	83-
(Leuciscus)		Sand Darter	
(Minnilus)		Sand-fish.	
· ·			
(Nocomis)(Notropis)	1	Sand-flounder	813
•		Sand Launce	
(Zygonectes)		Sand-pike	
rubripinna (Cliola)		Sand-shark	27
(Cyprinella)		sanguifluus	507
rubripinnis (Minnilus)	. 198	sanguineus	770
rubriviuctus	669	sanguinolentus (Oncorhynchus)	308
Rudder-fish	445, 452	(Pomotis)	478
rufa (Harpe)	60I	(Salmo)	308
rufilineatus		sapidissima (Alosa)	268
rufus (Bodianus)		(Clupea)	267
(Cossyphus)	1	sapidissimus (Coregonus)	299
(Labrax)		Sarcidium	205
rufus (Labrus)		Sarda	427
		sarda (Pelamys)	428
rugosus	. 830	Sarua (1 Clamys)	420

	Page.		-Page.
Sardine	266	Scophthalmus	81
Sardinia	887	scopiferum	207
Sargo	551, 930	Scorpaena	951, 95:
Sargus	557	Scorpanichthys	716
Strothrodus	614	Scorpænidæ	650
Sarpo	750	scorpioides	70:
satiricus	761	Scorpion	679
erturna	572, 573	Scorpis	561
Sauger	526	scorpius	70:
Saurel	431, 432	scouleri301,	305, 308
Saurina	279	scripta	859
Saurus	279	scrutator (Belone)	374
saurus (Elops)	261, 968	(lsesthes)	960
(Oligoplites)	973	Sculpin	682, 70:
(Scomberesox)	375	Scnp	557
(Trachurus)	432, 912	Scuppaug	557
Saury	374	scutellatus	373
Saw-tish	36, 37	scuticaris	358
Saw-kwey	306	scylla	168
saxatilis (Chartodon)	611	Scylliidæ	57, 58
(Glyphidodon)	611, 939	Scylliorhinus	58, 869
(Pacilichthys)	515	Scyllium	58, 869
(Pomacentrus)	611	Scymnidae	3:
axicola	837	Seyris	438
sayanus	460, 461	Seytalina	790
sayi48	69, 879	Sea Bass	526, 53:
Sayris	347	Sea-bat.	850
scaber	644, 949	Sea Catfish	110, 111
scabriceps	194	Devil	5:
Sead	432	Ilorse	386
Scamp	538	Foacher	72
Scaphirhynchus	88	Raven	683
Scaphirrhynchops	88	Robin	7:3:
scaphinrus	943	Trout	579, 586
Scarine	598	Snail	733
Scarus	607, 938	Sebastapistes	673
Scatophagus	673	Sebastes	65
sceptions	200	Sebastichthys652,	655, 67
Schilbeodes	98	Sebastodes	
scheepfli	858	Sebastomus	
schranki	925	Sebastoplus	65
Schuylkill Cat	104	Sebastosomus	654, 65
sciadicus	342	sectatrix	56
Sciaena	569, 931 <sup>-1</sup>	secundodorsalis	42
Sciaenidae	566	segalieusis	72
Scieninæ	566	Sclache	3
Scianops	571	Selachians	11
scitulus	956	Selachii	1:
Selerodermi	853	Selaehost mi	8
Sclerognathus	117, 883	Selar	433, 43
Scoliodon	24, 60	Selene	43
scolopaceus	366	selene (Carpiodes)	12
scolopax	388	(Luxilus)	18
Scomber	422	(Minnilus)	18
scomber	421	selenops	26
Scomberesocidæ	371	semicinetus	603, 60
Scomberesox	374	semifasciata (Etheostoma)	50
Scomberomorus	425	semifasciatum (Pilcoma)	50
Scombridae	422	semifasciatus (Triacis)	2
Scombrocottus	649	seminolis	33
Scombroides		seminuda (Gila)	23
Scombroiding	431	seminudus (Lycodes)	78
scombrus		semiscabra	69
Scopelidæ		Semotilus	99
Scopelus	281	senilis	346, 89
			,

P	age.	P	age.
Señorita	604	simpsoni	109
senticosa	851	simulans (Enneacanthus)	470
serena	157	(Hemioplites)	471
Sergeant-fish	909	(Sebastosomus)	658
Seviola	2, 913	simus (Alburnellus)	170
Seriolichthys	446	(Rhinichthys)885	5, 886
Seriphus	582	Siphagonus	725
serpentinus778	3, 779	Siphostoma	5, 906
serra	276	siscowet317	
Serranidæ	526	Skate	39, 40
Serraninæ	527	Skim-back	120
Serrano	534	Skip-jack	2, 443
Serranus532, 916	917	Skipper	375
serrata (Fistularia)	390	Skittle Dog	16
serratum (Hæmulon)	924	Skowitz	307
serratus (Gasterosteus)	396	Sleeper	
serriceps		Sleeper-shark 1	3, 14
Seserinus	914	Sleepmarken	5
sessilicauda	840	sloani	, 285
setapinnis (Zeus)	440	Small-mouthed Black Bass	485
Setarches	682	Smaragdus	635
setifer	857	Smelt292	, 293
setipinnis	440	smiridus	809
sexmaculatus	863	smithii (Careharodon)	875
Shad	267	(Cyprinus)	260
Shad Waiter	298	Smooth Hound	19
Sharks	12	Snapper	, 651
Sheepshead558		Snipe Eel	365
Shiner	' I	Snipe-fish	388
Shovel-head Shark	25	Snooks	909
Shovel-nose	27	Soap-fish	543
Shovel-nosed Shark	62	socius	195
Sturgeon	88	Soft-rayed fishes	94
shumardi (Alburnops)	193	Sogo	459
(Hadropterus)	499	Soldier-fish	517
(Imostoma)	498	Sole	841
(Minnilus)	192	Solenostomatidæ	381
sialis	98	solis	
sieculus		somnolenta.	
Sidera	406	sonnoientasonoriensis	632
siderium	969	soporator	349
Sierra		sordidas	817
signatus	427 623	Southern Porgee	929
signifer (Bry*tus)	473	spadicea	155
(Coregonus)	110	spallanzani	
(Salmo)	303	Spanish Flag	669
(Stypodon)	224	Mackerel	
(Thymallus)302,		Porgy	939
Siluridæ	96	Sardine	887
Silus	295	Sparada	
Silver Chub	222	Sparidæ545,	
Eel	910	Sparinæ	546
Silver-fin		Sparisoma	938
*** ** ** **	570	sparoides	465
a .	307	Sparus	
	316	spathula (Polyodon) 83	
Carlo	404	(Squalus)	84
	170	spatula (Lepisostens)	92
Simenchelys	363	Spatularia	83
	593		171
(Fundulus)333,		Spear-fish120,	
(Hydrargyra)	333	speciosa (Gambusia)	
	451	speciosus (Pomotis)480,	
simotera	496	(Semotilus)	221

	Page.		Page.
speciosus (Trachichthys)	458	stearnsi (Corvina)	572
Speck	495	(Lutjanus)549,	921, 922
Speckled Trout	320	(Roncador)	572
spectabilis (Parcilichthys)	518	(Schena)	572
(Salmo)	320	(Scorpaena)	951
(Salvelinus)	320	(Seriola)	
	294		
spectrum		Steel-head	
spectrum ula		stegophthalmus	723
spelæus	324	stellaris	58
spengleri	861	stellatus (Fario)	315
spet	411	(Salmo)	315
Sphagebranchus	358	(Platichthys)	836
Sphyraena	410	(Pleuronectes)	835
sphyræna (Esox)	410, 411	stelleti (Cyclopterichthys)	745
sphyrænarum	970	(Cyclopterus)	745
Sphyraenidae	410	(Trichodon)	627
Sphyrna	26, 874	stellifer (Bodianus)	569
Sphyrnidæ	25	(Fundulus)	337
		stellifera (Corvina)	570
spillmani			
spilonotus		(Sciaena)	
spilopterus (Citharichthys)		(Xenisma)	337
(Leuciscus)	179	Stelliferus	569
(Photogenis)		stellulata	44
spilota694	, 953, 954	Stenodus	304
spilurus	314	Stenotomus	929, 972
Spinacidæ	15	Stephanolepis	856
spinarella		stephanophrys	736
spinicephalum		Stereolepis	531
spinosissimus	727	Sterletus	85
= -			
spinosus (Calycilepidotus)		sterletus	216
(Cyclopterus)		Sternoptychidæ	283
(Echinorhinus)	14	stevensi	
(Eumierotremus)		Stichaus	775
(Hemilepidotus)	714	Stichæidæ	754
(Squalus)	14	Stickleback392,	395, 396
Spiny Eels	368	stigma	789
Spiny-rayed fishes	397	stigmaa (Ulocentra)	495
Split-tail		stigmæus (Citharichthys)	960
Split-mouth Sucker		stigmatiens (Ceratichthys)	212
Spoon-bill Cat		(Gobionellus)	947
Spot		(Smaragdus)	947
•		-	
Sprat.		stigmatura (Cliola)	183
Spratella		(Codoma)	189
Spratelloides		stigmaturus (Gobius)	940
Squali		(Photogenis)	182
squalidus (Scarus)	938	Stilbe	248
squalipeta	. 909	Stilbius	25.
Squalius	230	stilbius	201
Squalus	. 16	Stingaree	47
squamatus	241	Sting Rays	45, 47
squamiceps		Stizostedion	523
squamilentus (Ceratichthys)		Stizostedium	
(Conesins)		Stousodon	879
(Paralichthys)		Stolephorus	
Squamipinnes			
		Stomias	
squamipinnis (Gerres)		stomias (Atheresthes)	820
Squatina		(Platysomatichthys)	82
squatina		(Salmo)	310
Squatinidae		(Trisotropis)	
Squeteague		Stomiatida	
Squirrel-fish		Stomodon	80
Squirrel Hake	. 799	Stone bass	53
stagnalis	. 221	Stone-cat	97, 10
Star-gazers		Stone-lugger	
stearnsi (Blennius)		Stone Roller	
,	-50	1	, ,

			A digita
Stone-toter	160	synagris	922
storeri (Leuciscus)	221	Synaphobranchidæ	364
(Scomberesox)	375	Synaphobranchus	364
storeriana 17	0, 171	Synentognathi	371
storerius	465	Syngnathidæ	. 382
stonti	7, 867	Syngnathus	382
straminea 16	7, 168	Synodus	280, 889
Strawberry Bass	465	Syrrhina	63, 876
striatus (Anthias)	919	syrtensium	293
(Epinephelus)	918		
(Roccus)	528	T.	
(Serranus)	919	tabaccaria	389
strigatus	736	tænia (Blennius)	760
Striped Bass	529	(Clinostomus)	284
Mullet	403	(Murænoides	760
Stromatcidæ	449	(Squalius)	234
Stromateus	450	tæniatus	55:
stromi	813	taniops	919
strnmosus 74	9, 957	tæniopterus	70
Stud-fish	337	Taniotoca	59
Sturgeon	82, 84	tahoënsis	12
sturio	85	Tailor Herring	266
stylifer	907	Tambor	860
Stypodon	223	tapdisma	309
suavis	6, 177	Tarpum	261, 265
subbifurcatus	775	tau	750, 75
subligarius	5, 917	Tanridea	69-
subterraneus	325	taurocephala	160
sucetta132, 13		Tantog	600, 930
Sucker	4, 578	Tautoga	
sucklii	17	tautoga	599
Sudis	277	Tautogolabrus	59
sueuri	5, 914	taylori	79
snillus	601	tchawytcha	307, 89
sujef	766	telescopus	20
Sukkegh Salmon	308	Telestes	236
summulentus	632	Telipomis	47
Sun-fish453, 462, 472, 48	2,865	temmincki	586, 59
Sunny	482	Temnistia	71
superciliosus (Aspidophorus)	723	Temnodon	44
(Hexagrammus)	644	tenellus	34
(Hyborhynchus)	160	tenuis (Atherinopsis)	405, 40
(Labrax)	644	(Gadus)	79
Surf-fish	4, 595	(Leuresthes)	40
Surf Smelt	294	(Phycis)	79
Whiting 57	7, 933	teres (Alosa)	26
Surgeon	616	(Catostomus)	
Surgeon-fish	617	(Cœcula)	89
surinamensis	555	(Cyprinus)	
surmuletus	565	(Etrumeus)	
Surmullet56	,	(Sphagebranchus)	
sutor	439	Teretulus	
swampinus	332	tcretulus	
swani	729	tergisus	
Swell-shark	59	terræ-novæ	24, 2
Swell-toad		tessellata (Etheostoma)	50 49
Swingle-tail	27	Tessellated Darter	
Sword-fish.	420	tessellatum (Boleosoma)	
symmetrieus (Caranx)		(Nanostoma)	
(Ceratichthys)	213	tesscllatus (Hadropterus)	
(Lepomis)	473	(Nothonotus)testudineus	
(Leucosomus)	213 213	Tétard	
(Pogonichthys)	432	Tetragonopterus.	
(Trachurus)	432 222	C. A	
Symmetrurus	كاندنو	Tetragonoptrus	01

	Page.	$\mathbf{P}_{i}$	age.
tetrapturorum	418	Toter	130
Tetrapturus	420	toxotes	596
Tetrodon		Trachinidæ	
Tetrodontidæ	859	Trachinocephalus	281
Teuthydida		Trachurops	
		Trachurus	
texana (Anguilla)	361		
(Cyprinella)	178	trachurus (Caranx)	
texensis (Dionda)	157	(Cottus)	715
(Cynoscion)	581	(Gasterestens) 395	
thalassinum (Moxostoma)	139	(Hemifepidotus)	715
(Nanostoma)	511	(Scomber) 432	
thalassinus (Lepidogobius)	947	(Trachurns) 432	,912
(Nothonotus)	511	Trachynotus	441
(Otolithus)	581	Trachypteridæ	617
(Ptychostomus)	139	Trachypterus	618
Thaleichthys	291	tractus	941
thaleichthys	292	tranquebar	724
thazard	911	transmontanus (Acipenser)	86
thompsoni (Carpiodes)		(Rhinichthys 207	
	119	traski	587
(Ictiobus)	883		
(Triglopsis)		Tree-fish	676
thoreanianus	221	triacanthus	451
Thread-fin	412		, 870
Thread-tish	438	tribulus	735
Thread Herring	268	Trichidion	413
Thresher Shark	26, 27	Trichinridæ	, 910
thrissa	268, 269	Trichiurus	422
thrissoides	262, 887	trichocephalus	862
Thunder-pumper	567	Trichedioden	862
thunnina	430	Trichodon	627
Thymallus	302	trichodon	627
thymallus	302	Trichodontidæ	
Thynnichthys	429	trichroistia	181
Thynnas		tricolor (Chartodon)	615
thynnus	429	(Holacanthus)	941
•		(Pomacanthus)	941
Thyris	840		
Tiaroga	163	(Thymallus)	303
tiburo25		trieuspis	
Tiger Sharks	21	tridentatus	
Tigoma	230, 233	tridigitatus	753
tigrinus (Galeocerdo)	21,60	trifureus534, 917	, 973
(Myrichthys)	360	Trigger fish	854
Tile-tish	624	Trigla 733	956
Tilesia	804	Triglidæ	, 880
tilesii	715	Triglops	712
(impanogensis	196	Triglopsis	709
timueu	902	trigonum	853
tincellus	245	trigrammus	644
Tipble	382	Triloburus	534
Tirodon	968	trilobus	720
Toad-tish		triqueter	966
Tobacco-box	40	triquetrum	965
(obianus		triserialis	
Togue		triseriatus	
	317		
loma	317	Trisotropis	
Tom-cod		trispinosa (Corvina) 570	, 931
tom-cod	806	trispinosus (Odontopyxis)	729
tomcodus	806	tristorchus	92
Toothed Herring	260	trivittatus	554
Top Minnow	338	Trochocopus	936
Торе	21	tropica (Echeneis)	970
Torpedinidæ	38	tropicus (Atractosteus)	92
Torpedo38, 39,	876, 877	Tront Perch	322
torpedo (Raia)	38	trowbridgii (Abcona)	588
torvus	688	(Homaloponius)	809

Thurmost fich			Page.
Trumpet-fish 388, 3	1	uninotatus	922
	74	Upeneus	565
	67	Upselonphorus	628
	66	Uranidea 693, 953,	954, 955
(Salmo)	· · · · · · · · · · · · · · · · · · ·	uranops (Phenacobius)	206
· · ·	67	Uranoscopidæ	627
	352	uranoscopus (Mancalias)	848
·	47	uranoscopus	848
Trygon 47, 8	379	Urolophus	46
Trygonidæ	45	Uronectes	789
Trygonorhina	376	Urophycis	798
tsuppitch308, 315, 3	316	Uropsetta	821
tschawytscha 8	390	urns	116,883
tuberculatus	379	ustus (Calliodon)	606
tudes 3	20	utah	315
tuditana 165, 1	.66		
Tullibee	01	v.	
tullibee 301, 3	02	vacca	597
tumidus	83	vagrans 407,	908, 969
·	28	vahli	786, 787
tunicata	42	Vaillantia	493
Tunnies		vampyrus	53
	29	vandoisulus	232
Turbot		variabilis (Acanthocottus)	703
turgidus		(Perca)	
	88	(Sebastes)	659
	06	variatum (Etheostoma)	503
Tylosurus		variatus (Alvordius)	503
•	39	, (Pœcilichthys)	518
	24	variegatus (Cyprinodon)	
	39	(Limnurgus)	343
	87	velatum	138
	67	veliana	405
-		velifer (Carpiodes)	
	61		120
•	69	(Ictiobus)	120
(Clupea)	70	(Letharchus)	896
U.		velox	166
		ventralis	708
	94	ventricosa (Apocope)	211
	16	(Temnistia)	715
	50	ventricosus (Blepsias)	715
	69	(Ceratichthys)	211
	00	(Cyclopterichthys)	745
	49	(Cyclopterns)	745
	75	ventriosus (Scylliorhinus)	59, 869
	76	venusta (Cliola)	178
· • •	76	(Cyprinella)	178
	32	(Limia)	343
umbrosus (Esox)		(Lucania)	343, 893
	34	vermicularis (Sparus)	922
	31	vermiculatus (Xyrichthys)	605,973
	50	vernalis (Clupea)	267
	50	(Gobio)	214
	93	(Pomolobus)	267
	28	(Scomber)	424
	576	verrilli	786
undulatus (Menticirrus) 578, 932, 9	33	verrucosus (Brachyopsis)	726
	75	(Cottus)	707
unicolor (Ammocœtes)	68	(Leptagonus)	955
	77	versicolor (Abramis)	250
	18	(Argyrops)	929
unifasciatus	76	(Labrus)	929
unimaculatus (Argyreiosus)	40	(Stenotomus)	929
(Clinus)	75	verticalis	829
	75	verus	875

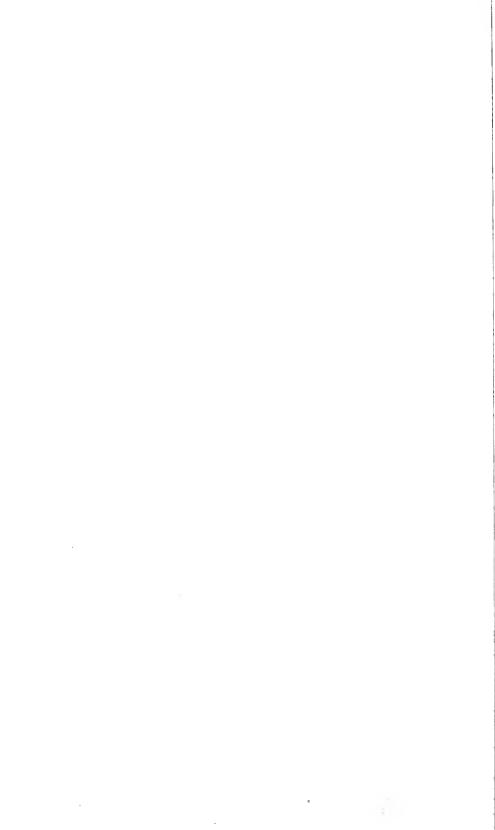
•	rage.		Page.
vespertilio (Holorhinus)	51	volucella	168
(Malthe)	850	Vomer	
(Rhinoptéra)	51	vomer	
vetulus (Balistes)	855	vomerinus	781
(Parophrys)	832	vorax	229
(Pleuronectes)		vulgaris (Acanthias)	17
vexillare (Boleosoma)	493	(Amiurus)	103
vexillaris		(Anguilla)	36
vheeleri		(Auxis)	425
Vieja Muger		(Belone)	372
vigilax		(Brosmius)	803
vigilis		(Carcharias)	873
villosa (Clupea)	291	(Carcharinus)	873
villosus (Cottus)		(Conger)	363
	291		
(Mallotus)		(Hippoglossus)	819
vinctipes .i		(Liparis)	743
viola		(Lota)	802
violaceum (Ditrema)		(Merlucius)	809
violaceus (Apodichthys)	774	(Molva)	801
(Cebedichthys)		(Mustelus)	19, 20
Viper-tish		(Pagrus)	556
virens	806	(Pinuclodus)	105
virescens (Apodichthys)	770	(Pomotis)	480
(Pantosteus)	124	(Sphyræna)	411
virgatulus	957	(Thynnus)	429
virgatus (Delolepis)	779	vulnerata (Apocope)	210
(Pecilichthys)	515	vulneratus (Nothonotus)	508
virginalis	315	(Pœcilichthys)	509
virgiuicum (Pristipoma)	552	vulpes (Albula)	258
virginiens (Anisotremus)	552	(Alopecias)	27
(Pomadasys)	552, 923	(Alopias)	27
(Sparus)	552	(Esox)	258
virginianus (Acanthocottus)	701	(Pinielodus)	109
viride (Ophidium)	789	(Squalus)	27
viridis (Centrarchus)	468	vulsus	730
(Centropomus)	$52_{8}$		
(Chænobryttus)	468	W.	
(Esox)	92, 880	wachna	808
(Gymuclis)	789	Wall-eyed Perch	591
(Lepidosteus)	92	Pike	529
viridescens (Syngnathus)	383		
(Osmerus)	293	War-mouth	
viscosa	698	warreni (Bolerchthys)	521
vitrea (Ioa)		(Pacilichthys)	521
		44.1.	45.114
	490	(Salmo)	309
(Perca)	525	Warsaw	920
(Perca)vitreum (Stizostedium)	525 525	Warsaw Weak-fish	920 579, 581
(Perca)	525 525 491	Warsaw Weak-fish webbi (Blennophis)	920 579, 581 756
(Perca)	525 525 491 415, 909	Warsaw Weak-fish webbi (Blennophis) (Embiotoca)	920 579, 581 756 593
(Perca) vitreum (Stizostedium) vitreus (Pœcilichthys) vittata (Argyrotænia) (Cliola)	525 525 491 415, 909 172	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius)	920 579, 581 756 593 756
(Perca) (Perca) (Vitreum (Stizostedium) (Vitreus (Pœcilichthys) (Vitrata (Argyrotænia) (Cliola) (Cliopa)	525 525 491 415, 909 172 273	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi	920 579, 581 756 593
(Perca) vitreum (Stizostedium) vitreus (Pæcilichthys) vittata (Argyrotænia) (Cliola) (Clupca) (Codoma)	525 525 491 415, 909 172 273 172, 173	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri	920 579, 581 756 593 756
(Perca) (Vitreum (Stizostedium) (Vitreus (Pæcilichthys) (Vitata (Argyrotænia) (Cliola) (Clupea) (Codoma) (Hemitremia)	525 525 491 415, 909 172 273 172, 173 162	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi	920 579, 583 756 593 756 393
(Perca) vitreum (Stizostedium) vitreus (Pæcilichthys) vittata (Argyrotænia) (Cliola) (Clupca) (Codoma)	525 525 491 415, 909 172 273 172, 173	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri	926 579, 581 756 593 756 393 693
(Perca) (Perca) (Vitreum (Stizostedium) vitreus (Pœcilichthys) vittata (Argyrotænia) (Cliola) (Clupea) (Codoma) (Hemitremia) (Lepidomeda) vittatus (Animodytes)	525 525 491 415, 909 172 273 172, 173 162 252 115	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri whipplei (Boleichthys)	926 579, 583 756 593 756 393 693 516
(Perca) (Perca) (Vitreum (Stizostedium) vitreus (Pœcilichthys) vittata (Argyrotænia) (Cliola) (Cliopa) (Codoma) (Hemitremia) (Lepidomeda) vittatus (Anmodytes) (Engraulis)	525 525 491 415, 909 172 273 172, 173 162 252 415 273, 888	Warsaw Weak-fish webbi (Bleunophis) (Embiotoca) (Ophiobleunius) wheatlandi wheeleri whipplei (Boleichthys) (Cliola)	920 579, 581 756 593 756 393 693 516
(Perca) (Perca) (Vitreum (Stizostedium) (Vitreus (Pœcilichthys) (Vitrata (Argyrotænia) (Cliola) (Clupea) (Codoma) (Ilemitremia) (Lepidomeda) (Vitrata (Anmodytes) (Engraulis) (Esox)	525 525 491 415, 909 172 273 172, 173 162 252 415 273, 888 352, 894	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella)	920 579, 581 756 593 756 393 693 516 178
(Perca) (Vitreum (Stizostedium) (Vitreus (Pœcilichthys) (Vitreus (Argyrotenia) (Clola) (Clupea) (Codoma) (Hemitremia) (Lepidomeda) (Vitratus (Anmodytes) (Engraults) (Esox) (Viuva	525 525 491 415, 909 172 273 172, 173 162 252 415 273, 888 352, 894 660	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella) White Angel.	920 579, 583 756 599 756 399 699 510 178 178
(Perca) (Perca) (Vitreum (Stizostedium) (Vitreus (Pœcilichthys) (Vitrata (Argyrotænia) (Cliola) (Clupea) (Codoma) (Ilemitremia) (Lepidomeda) (Vitrata (Anmodytes) (Engraulis) (Esox)	525 525 491 415, 909 172 273 172, 173 162 252 415 273, 888 352, 894 660	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella) White Angel Whitebait	920 579, 583 756 599 756 399 699 516 178 178 940 269
(Perca) (Vitreum (Stizostedium) (Vitreus (Pœcilichthys) (Vitreus (Argyrotenia) (Clola) (Clupea) (Codoma) (Hemitremia) (Lepidomeda) (Vitratus (Anmodytes) (Engraults) (Esox) (Viuva	525 525 491 415, 909 172 273 172, 173 162 252 415 273, 888 352, 894 660	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella) White Angel Whitebait White Bass Cat	92(579, 58) 756 596 756 396 697 516 178 946 266 526
(Perca) (Vitreum (Stizostedium) (Vitreus (Pœcilichthys) (Vitreus (Argyrotenia) (Clola) (Clupea) (Codoma) (Hemitremia) (Lepidomeda) (Vitratus (Anmodytes) (Engraulis) (Esox) (Viuva	525 525 491 415, 909 172 273 172, 173 162 252 415 273, 888 352, 884 660 169, 970	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella) White Angel White bast White Bass Cat	92(579, 58) 756 596 756 396 697 516 178 946 266 526
(Perca) (Perca) (Vitreum (Stizostedium) vitreus (Pœcilichthys) vittata (Argyrotænia) (Cliola) (Clupea) (Codoma) (Hemitremia) (Lepidomeda) vittatus (Ammodytes) (Engraulis) (Esox) Viuva vivax (Ammocrypta)	525 525 491 415, 991 172 273 172, 173 162 252 415 273, 888 352, 894 69, 970 169 652	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella) White Angel White bass Cat White-fish White Grunt	920 579, 583 756 593 756 393 693 510 178 178 940 263 524 107, 108 296, 626
(Perca) (Perca) (Vitreum (Stizostedium) vitreus (Pœcilichthys) vittata (Argyrotænia) (Cliola) (Clupea) (Codoma) ((Hemitremia) (Lepidomeda) vittatus (Anmodytes) (Engraulis) (Esox) Viuva (Ciola) vivivax (Ammocrypta) (Cliola)	525 525 491 415, 991 172 273 172, 173 162 252 415 273, 888 352, 894 69, 970 169 652	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatkandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella) White Angel White Bass Cat White-fish 269 White Grunt Hake	92(579, 58) 756 593 756 393 699 516 178 946 266 522 107, 108 296, 626 799
(Perca) (vitreum (Stizostedium) vitreus (Pœcilichthys) vittata (Argyrotænia) (Cliola) (Clupea) (Codoma) (Ilemitremia) (Lepidomeda) vittatus (Ammodytes) (Eagraulis) (Esox) Viuva vivax (Ammocrypta) (Cliola) viviparus Volador volitans (Cephalaeanthus)	525 525 491 415, 991 172 273 102 252 115 273, 888 352, 894 660 169, 970 169, 970 652 378, 738	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatlandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella) White Angel White Bass Cat White-fish Hake Mullet	926 579, 581 756 599 756 399 511 178 178 946 266 529 107, 108 296, 626 799 139, 403
(Perca) (Perca) (vitreum (Stizostedium) (vitreus (Pœcilichthys) (citata (Argyrotænia) (Cliola) (Clupea) (Codoma) (Ilemitremia) (Lepidomeda) (vittatus (Animodytes) (Engrauls) (Esox)  Viuva (vivax (Ammocrypta) (Cliola) viviparus Volador	525 525 491 415, 991 172 273 172, 173 162 252 115 274, 888 352, 894 660 169, 970 1692 378, 738 957	Warsaw Weak-fish webbi (Blennophis) (Embiotoca) (Ophioblennius) wheatkandi wheeleri whipplei (Boleichthys) (Cliola) (Cyprinella) White Angel White Bass Cat White-fish 269 White Grunt Hake	926 579, 581 756 599 756 399 511 178 178 946 266 529 107, 108 296, 626 799 139, 403

	Page.	•	Page.
White Trout	580	Yellow Cavallé	440
Whiting	299,577	Yellow-fluned Roncador	570
williamsoni (Coregonus)	297,968	Yellow Perch	524
(Gasterosteus)	394	Pike	528
wilsoni	697	Yellow-tail 269, 444, 446, 570,	, 625, 65
winchelli	214	Yelting	54
Window-pane	815	y-græcum	629, 94
Winter-Flounder	837		
Winter Salmon	306	Z.	
Wolf-fish	781		
Wrasse-fishes	597	zaehirus	83
Wreck-fish	532	zanemus	21'
Wry-mouth	780	Zaniolepis	64
würdemanni	634, 945	Zapteryx	870
		zatropis	
X.		zebra (Fundulus)	
xænocephalus	192	(Gerres)	93
xa·nura	184	(Hydrargyra)	333, 33
xanthocephalus	104	zebrinus	89
xanthurus (Homoprion)		Zenidæ	45
(Liostomus)		Zenopsis	45
(Rhombus)	,	Zoarces	78
(Sciæna)		Zoarcidæ	78
(Seserinus)	914	zonale	51
xanti		zonata (Cliola)	18
Xenichthyinæ.		(Seriola)	445, 91
Xenichthys		zonatum (Elassoma)	,
xenicus		zonatus (Alburnus)	18
Xenisma		(Ephippus)	
Xenistins	920	(Esox)	
Xenotis		(Fundulus)	
Xiphias		(Haplochilus)	
	419 771	(Leuciscus)	
Xiphidion		(Scomber)	44
Xiphidiontida		(Zygonectes)	
Xiphiidæ	,	Zonichthys	,
Xiphister		zonifer	
Xiphisterinæ		zonistius	
Xiphophorus	346	Zophendum	
xyosternus		•	
Xyrichthys		zophera	
Xystreurys		zostera	
Xystroplites	472,480	zumensis	
Υ.		Zygæna	_
	500	zygæna	
Yellow Bass	530	Zygonectes338	
Cat	102, 105	zyopterus	87





· 3			







	/		

